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POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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EE PAGE 712

I'll make *you* an EXPERT MECHANIC *in 8 weeks*

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I Will Pay Your Railroad Fare— and Give You the Lowest Tuition Rate Ever Offered

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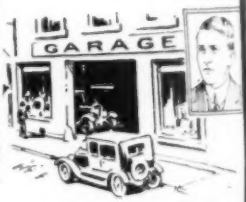

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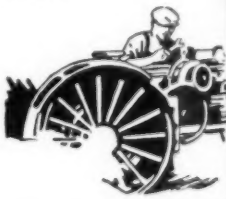

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[Contents—Continued]

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Vol. 43

Contents for May, 1925

No. 5

Aerial Postal Service—latest airplane safer, faster ... 813
Aeronautics—air mysteries bared to aid flight ... 723
Agriculture—disease immune plants sought ... 759
Airships
  baby blimp for air touring ... 712
  new daughters of the sea ... 795
Ambidexterity—more men than women left-handed ... 800
Animals—ambulance for cats and dogs ... 802
Ants—war on, to help farmers ... 792
Asphalt—paving the world's streets ... 808
Astronomy—modelers make life mask of moon ... 721
Athletics—coach invents pacer for runners ... 729
Atmosphere—air waves like ocean waves but larger ... 808
Automobile
  autos carry inaugurating party through sewer tunnel ... 764
  value of nation's autos ... 768
Automobile Touring—house car built of airplane wood ... 752
Automobiles—Design—automobiles built in queer shapes ... 793
Automobiles—Equipment and Supplies—bumper serves as baggage rack ... 754
Automobiles—Lighting
  lights dimmed by foot switch ... 824
  lights under auto cause car to show up ... 753
Automobiles—Safety Devices
  auto brake bands riveted tight ... 749
  rubber link chains for auto tires ... 774
Aviation
  airplane ambulances in army use ... 817
  aviators find hidden mountain pass ... 784
  bomb pistol to guide airplanes ... 750
Banks and Banking—deposit chutes in outer wall ... 813
Barges—motor driven steel, looks like submarine ... 754
Beds—on rails on top of skyscraper ... 713
Birds—seek old homes each year ... 749
Blood—science to manufacture? ... 786
Boats and Boating
  ancient royal barge of Turkey in drydock ... 782
  lifeboat with hand levers ... 753
  two thousand miles by water flivver ... 769
  water craft floated on air balls rowed like canoe ... 717
Bones—China's trade in ... 767
Bridges
  railway bridge planked for autos serves during washout ... 811
  tide lifts concrete bridge span on boat ... 737
  traffic treads save wood bridges ... 751
Building—raft floated in standpipe for wrecking crew ... 708
Building Materials—decay in stone buildings ... 776
Cabbages—prize cabbage at show ... 812
Calculating Machine—double faced pocket calculator ... 808
Chinese—sailors make queer costumes ... 792
Chlorine—gas given in home with mask ... 759
Cigars—electric cigar sorter ... 776
Cleaning—portable motor concrete finisher ... 807
Compass—for ceiling of automobile ... 717
Crimes—armored motorcycle bank patrol ... 708
Cross Word Puzzles—puzzle frame with loose letters ... 750
Dentistry—auto equipped as dentist office ... 813
Disabled—armless write with pencil in belt on chest ... 754
Drawings—tool for designs has many uses ... 738
Drills—tool for cutting holes in metal ... 823
Earth—weighing the world ... 739
Education—camp schoolhouse on wheels moved by locomotive ... 816
Electric Batteries—connecting dry-cell batteries ... 852
Electric Power—half of nation's used in homes ... 767
Energy—movements of body measured by heat units ... 802
Eyes
  how to avoid strain on ... 823
  ills revealed by photographs ... 740
Fire Protection—fire fighting on the waters ... 730
Flags—inspiration of "Star Spangled Banner" ... 793
Gas—5,000 new ways of using gas ... 708
Gas Burners—gas water heater with fuel control valve ... 823
Glands—making giants out of mice and men ... 705
Glass—rival of, bounces like ball ... 791
Gold—roaches give clue to lost mine ... 824
Golf
  double tee made of rubber ... 763
  sandless golf ball scrubber ... 707
Great Salt Lake—waters expanding ... 774
Gulls—Great Lakes gulls cover world on winter flights ... 712
Hats—shaped with electric sandbag ... 750
Household Devices ... 814
Inventions—two hundred daily ... 763
Irrigation—dam in India ... 762
Jacks—jack and tackle develop six ton pull ... 758
Kansas—more forest trees in Kansas now ... 760
Kitchen—for campers folded in box for running board ... 740
Leaning Tower of Pisa—new base for ... 720
Life Saving Apparatus
  life preserver permits sitting mattress used as ... 741 800
Light—artificial sunshine in zoo for tropical birds ... 763
Lightning—oak common lightning target ... 811
Loading and Unloading
  house moved across cemetery on elevated tracks ... 759
  truck dumps brick in neat pile ... 742
Locomotives—100th anniversary of ... 755
Lost and Found Articles—on railway trains ... 802
Mail Box—revolving stand for mail boxes ... 808
Mechanical Drawing—fountain pen for draftsmen ... 817
Medicine—Practice—medicine taken through skin with electrical apparatus ... 768
Mines and Mining—balance scale finds ore deposits by pull of gravity ... 764
Monorail—propellers to drive passenger cars on overhead system ... 751
Mosquito—young mosquitoes starved by poisoning their food ... 784
Motherhood—memorial to motherhood to be built at capita ... 776
Motorcycles
  broad jump contest ... 742
  fitted to fight forest fires ... 793
  quick action stand for motorcycle ... 720
  wire streamline body ... 767
New York City—how Broadway got its name ... 740
Parachute—falling a mile for a diploma ... 715
Patents—30,000 English patents ... 738
Petroleum—hay rids harbor water of oil ... 816
Photography
  color photos at one exposure ... 807
  exposure meter for prints ... 719
Pigeons—airplane coop carries to races ... 784
Pliers—pocket, shaped like a wrench ... 767
Porcelain—imitation porcelain and marble from feldspar ... 792
Postage Stamps—60,000 in world ... 823
Postal Service—mail box on street car ... 774
Potatoes—oil from potatoes unfit for food ... 768

[Continued on Page 4]

Press—inkless, turns out complete typewritten letters 811
Prize Offers and Announcements 879
Propellers
four bladed propellers on "Leviathan" 760
more speed on less fuel with dummy propeller 775
Radio
how to pick your set 777
questions and answers 880
several languages spoken at once through relay system 751
Radio Aerials
aerial supports of metal improve reception 785
circular, non-directional aerial 737
Radio Antennas—talking tape for indoor aerials 759
Radio Apparatus
device protects tubes 860
making cushioned sockets 860
rheostat permits neat mounting 860
Radio Application
letters sent through space by radio 809
radio fog signal service to be extended 793
radio the latest crime detector 709
Radio Broadcasting
radio signals artists 738
records of announcer's voice correct faults 722
what super-power means 775
Radio Construction
how to lay out and drill panels 853
inspect aerial and ground before summer 860
label your battery leads 860
Radio Loud Speakers—tiny, three by five inches 741
Radio Phones—small, fit in the ears 708
Radio Photography—fans draw picture broadcast by artist 763
Radio Receivers
combined clock, radio and phonograph 764
getting the best for your set 847
one-tube ultraaudion a favorite 860
set concealed in doll's body 720
two-tube loud speaker 857
Radio Repairing—improvising shaft extension 852
Radio Tubes
examine "dead" transmitting tubes 859
show wide use of radio 786
Railroad Accidents—caboose plays leapfrog in wreck 791
Railroads—dining room on wheels 824
Railroads—U. S. A.—new and abandoned in 1924 713
Rats—rat and weasel run cable under river 752
Road Making Machinery—burlap spreader for cement roads 737
Rust—tallow dipped steel wire binds bridge to concrete base 782
Safety Movement
street booth holds stretcher 781
traffic police dummy at crossing 816
Sahara Desert—express offers variety of travel 785
Screws—driven into metal like nails 807
Seals—herding of Alaskan increases trade in skins 741
Signs and Signboards—three signs occupy same space 760
Slide Rule—holder with rubber pad 800
Solder and Soldering—regulating heat of soldering irons 856
Stage Mechanism—ropes back of stage 749
Stains—chart tells how to clean fabrics 816
Steamships and Steamboats—ventilators used as water intakes 791
Stone Mountain—huge granite block cut from 768
Stones—making cast stone 743
Street Traffic Regulations—three speed sidewalks in subways 707
Submarines—guns of, guarded by glass 786
Sun—animal increase due to sun spots 722
Swimming—bathing cap with "ear pockets" 719
Swings—rock like boat on waves 774
Telephone—booth with lattice legs 811
Tobacco—tested with mirrors 785
Toothbrushes—where toothbrushes grow on trees 754
Toys—dolls with interchangeable heads 802
Tractor—and plow lay radio ground wire 822
Trays—folding, carried with one hand 812
Truss—adjustable auto truss and jack 722
Turtles—turtle farm earns profit 781
Typewriters—balanced in desk 785
Vacuum Cleaners—for army mules 729
Ventilation—washing air for homes 765
Vocations—opportunities in building trades 818
Watches—manufactured by machinery 817
Weather
and the ocean currents 787
tree rings tell conditions 713
Weatherstrip—shaper run by motor 791
Welding—electric "insect" welds steel 729
Wheels—flexible disk auto truck 801
Wolves—war on 812
Woman—Occupations—woman's work in many fields 719
Wood Carving—carving furniture by machinery 803
Wood—fluid ends blue stain losses 786
Woodwork—electric shaping tool fits hand 801
Wool—paper-lined sacks for shipping 807
Words—origin of seagoing 822
X-Rays—for treating whooping cough 761

AMATEUR MECHANICS

Automobiles—Repairing
preparing car for summer driving 833
silent top buckle for Ford 837
Boats and Boating
barrel canoe for bathers 845
paddle for child's rowboat 830
Boots and Shoes—preventing uneven wear on heels 842
Brushes—how to care for 830
Built-in Furniture—Part VI—furnishing a clothes closet 839
Cookery—paper tells baking temperature 841
Cork—bottle cork holder 830
Electric Lighting—making trouble lamp 842
Electricity—electric cord troubles 846
Enamel—enameled ironware 842
Fishing
clamp for fishpole 846
separating telescopic fishing rods 831
Football—air valve for bladder 841
Garden Tools and Appliances—electrically heated sprout box 836
Gardens
build hotbeds early 837
planting back-yard garden 823
Glass—plate glass scalloping tool 846
Goats—nursing kids artificially 831
Golf—vulcanizing golf balls 830
Infants—portable baby yard 842
Mailbox—rack on country corner 831
Mops—old stockings make 836
Photography—drying prints quickly 846
Potatoes—thawing frozen 845
Poultry—teaching young chicks to roost 845
Printing—homemade printing press 843
Sports—water dice 837
Tool Box—handle makes, of drawer 841
Waterproof—cloth, how made 837

SHOP NOTES

Automobiles—Repairing
handling Ford driveshafts 865
inserting valve spring pins 869
Blueprints—quick way of making notations on 874
Boring Bar Holder 865
Burlap—treatment for mildewed 878
Carpentry—spacing nails in boxes 862
Dredges—overcoming dredging difficulties 876
Garage—service cards in 869
Gasoline—safety basin for washing small machine parts in gasoline 876
Glass—stain for glass windows 863
Hayrack—substitute for binding pole 871
Irrigation—small irrigation plant 870
Ladders—adjustable footing for ladder 864
Lathes—truing chuck backplate 870
Loading and Unloading—method of dumping trucks 864
Lubrication—lubricating high-speed shafts 863
Metals
joining roofing metal sheets 871
testing machine parts for cracks 865
Molding—concrete molds for making fender tools 874
Oil—good drying 875
Paint—removing paint and varnish 869
Painting—precautions in 878
Polishing Wheels—storing 868
Poultry—feeding troughs for 863
Pulleys—pulley and gear speeds and sizes 866
Signs and Signboards—moving signs for small stores 878
Swine—wheeled hog swiller 878
Threading—holes in thin plate 871
Tools—board on which to hang 875
Trailer—unusual automobile 873
Trees—whitewashing 869
Ventilation—ventilating the dark room 861
Vulcanizer
foot operated 875
rollers aid in testing tubes 863
Wagons
low wagon for silo filling 861
wood sled on wheels 873
Welding—portable welding outfit on motorcycle 874

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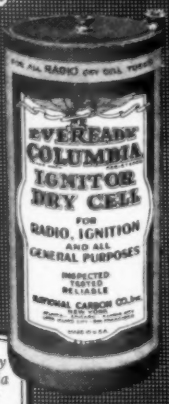

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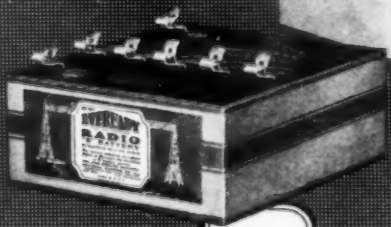

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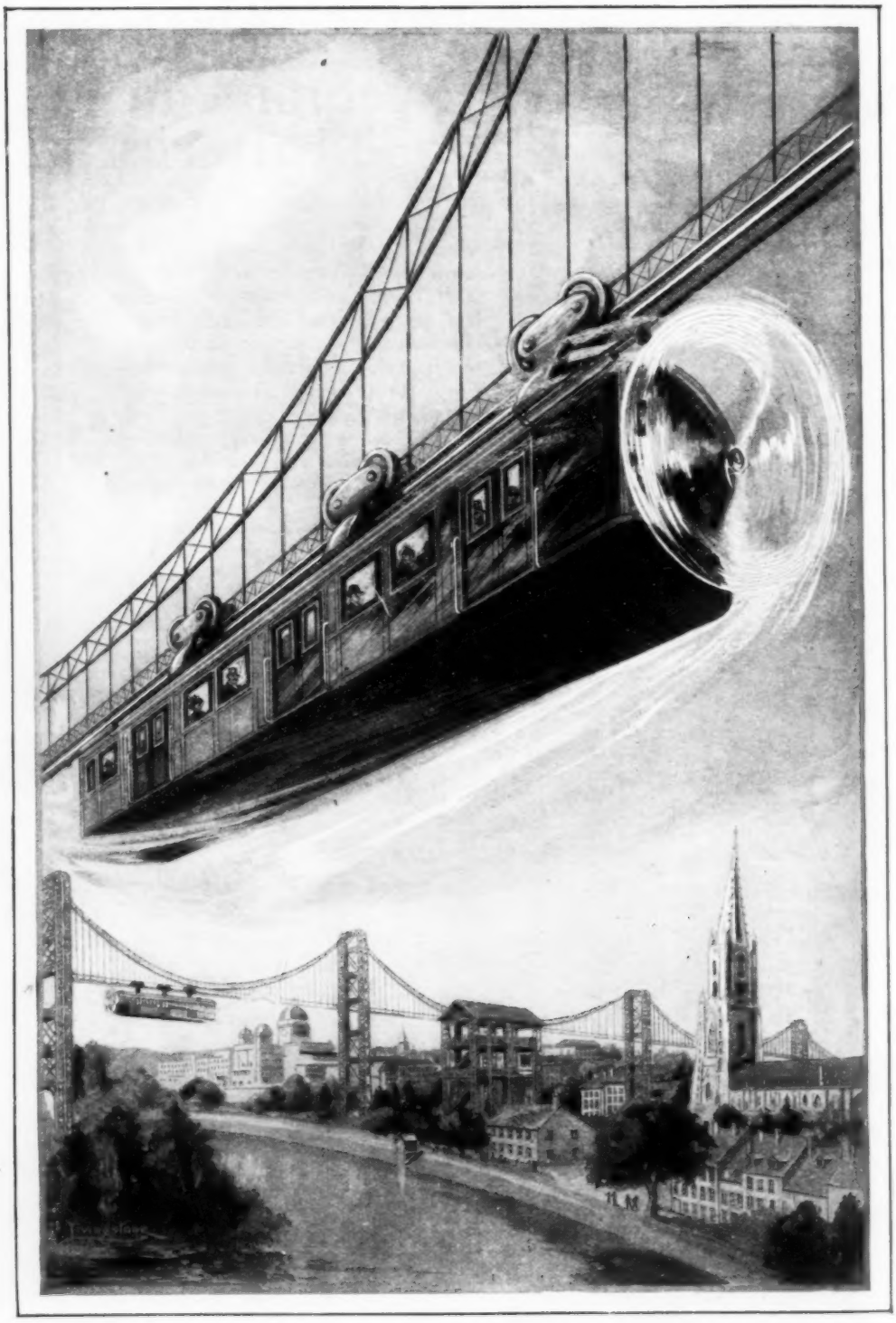

Sketch of Monorail Line to Be Built in Paris, Showing How Propeller-Driven Car Will Be Suspended; Power Will Be Supplied from Electrified Track or from Internal-Combustion Engine in Train—See Page 751

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Making Giants Out Of Mice and Men

Huge California Condor, the Size of Which Is Attributed to the Fact That It Eats the Brains of Its Prey

By H. H. DUNN

RATS as large as raccoons and guinea pigs as big as badgers are possibilities as a result of a discovery by a scientist of the University of California, while its application to cattle, sheep and hogs, as well as to geese, ducks and chickens, would result in such an increase in size and rapidity of growth that one-half the live stock now produced would furnish the same quantity of foodstuffs as those raised today.

The discovery was made, after nine years' work, by Dr. Herbert M. Evans, who also announced that he had found that barren animals may be made capable of producing young by feeding them with a certain food. The first of these findings is that the extract of the pituitary gland, a tiny organ hidden in the base of the brain, when injected into the tissues of living creatures, no matter what their age, starts a period of growth limited in time, amount and rapidity only by the quantity administered and the duration of administration. Rats born in the same litter and treated daily with "pituitrin" extract outgrew by fifty per cent other rats of the same litter reared under the same conditions but without pituitrin. Not only did the former grow faster but their growth stopped only when the treatment ceased.

"We were astonished to find," says Dr. Evans, "that if we treated animals with this fluid, provided it was not given by the mouth, but put under the skin or in body cavities where it would not come in contact with the digestive tissues, and was administered daily, rather than at infrequent intervals, we could turn normal animals into giants. Since everything else — food, light, warmth and age — was identical, one can be pretty certain that the effects the animals received from the treatment are due solely to the pituitrin. Very recently, Dr. Miriam E. Simpson and I have been able to show that even after the usual complete growth of adulthood is reached, on administration of this fluid the animals start again to add to their body." Dr. Evans says he does not know when it will be possible to apply this treatment to human beings, because his experiments are not yet complete, and because of the difficulty of obtaining a purified extract from the pituitary gland. The fluid which was used in the experiments was obtained from tadpoles. If, however,

Two Rats Used in Tests Designed to Show How Size Could Be Controlled by Feeding Them Pituitrin

the administration of the pituitary extract produces the same result in all rats, regardless of age or sex, there is every reason to believe that it will have the same effect on larger animals, even to man.

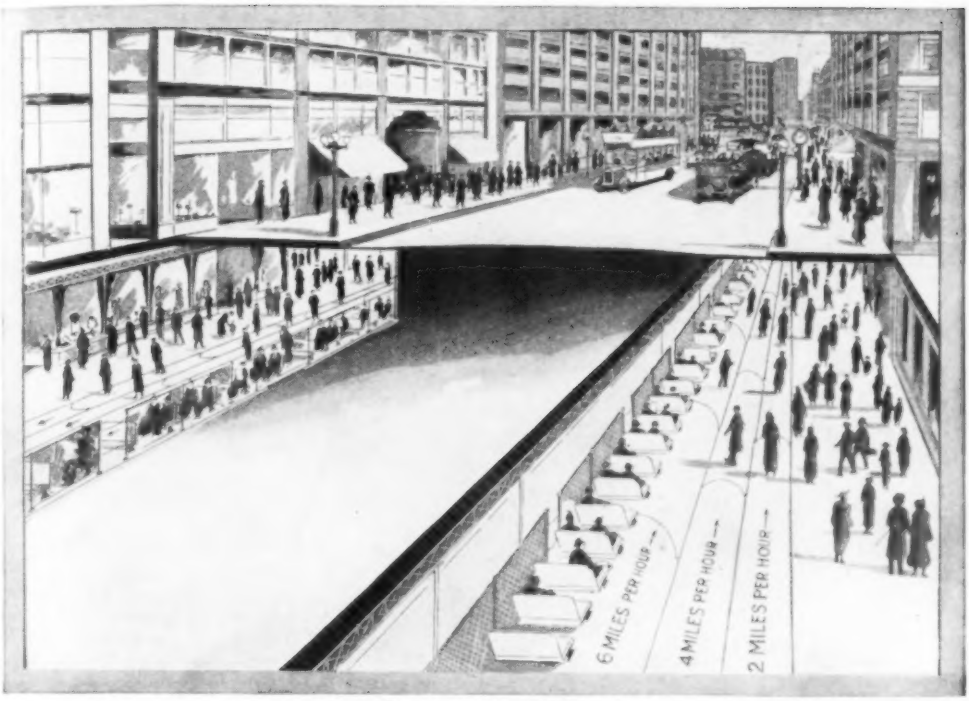
Most mammals and birds of large size are slow of growth, requiring two years or more to attain full size. An exception is the largest bird that flies, the California condor, which usually equals, and often surpasses in weight and wing spread, the condor of the South American Andes. Naturalists now are beginning to believe that this bird, which attains full growth in one year or less, is aided in its rapid development by the substance of the pituitary gland which it obtains from the brains of the animals on which it feeds.

Further experiments are to be tried on cattle, sheep, hogs and domestic fowl at the agricultural college of the University of California in an effort to produce larger animals in the time now required to rear the normal animal. Success would mean a large increase in the quantity of food meats produced in this country on the same amount of hay and grain, since animals so far experimented on eat no more while growing under the pituitrin treatment than they do when not so treated. If the experiments continue to be as successful on the larger animals and on men as they have been on rats—and Dr. Evans and his associates believe that they will be—another possibility is the elimination of the dwarf. A second result, and probably the greatest of all, would be the relief of the undersized, undernourished child and the use of this extract for building up the human body to make it more resistant to disease or to aid it in recuperating after disease. The delicate nature of the pituitary gland and its position at the base of the brain put it almost outside the pale of surgical operations. This condition has made the obtaining of the extract difficult and its administration to human beings almost impossible, until the discovery by Dr. Evans that the injection of the pituitrin from any animal into any other immediately starts the latter on its way to becoming a giant among its kind.

The second of his discoveries is a vitamin carried in an oil produced from the embryo, or germ, of wheat, which he has found essential to reproduction. Rats fed on certain foods, notably orange juice, became barren, or at least non-reproductive, but when given some of the wheat-embryo extract, immediately reared families. A diet of lettuce leaves has the same effect on the rats.

"Just how will this concern the practical problems of human welfare?" Dr. Evans asked, and replied to his own question:

"It is difficult to make any statement regarding the practical significance of the work, primarily because we have demonstrated that the new vitamin, which has been named vitamin X, is abundantly distributed in common foods. The fact that one set of organs has a dependence upon some substance which must flow in through the mouth, and cannot be fabricated in the body, is worth all the attention that we can give to it."



Protected from Autos and Street Cars, the Pedestrian in This Subway Arrangement Enjoys an Unobstructed Sidewalk, and Three Platforms Moving at Different Speeds in the Same Direction

Three-Speed Sidewalks in Subways Planned to Relieve Congestion

Sidewalks built in the form of separate moving platforms to carry pedestrians at two, four and six miles an hour have been proposed for a subway in a southern city. They are to be built next to the stationary passage and so arranged that persons may step from one to another with little trouble. Seats are provided for the fastest one. They will move in the one direction on one side of the street and in the opposite on the other. The arrangement, engineers believe, might eliminate the need for trains in sections where only short distances are traveled.

Sandless Golf-Ball Scrubber Saves Players' Hands

A golf-ball washer which cleans the spheres quickly without the use of sand to dislodge particles of grass and dirt, has been devised for installing on teeing stands. The scrubber, which performs its work with a few strokes of a plunger, relieves the players of the need of wetting their hands to dip the balls in water. Fitted with a bracket which allows the can to be tilted and emptied when cleaning, the apparatus is small enough to be attached to the side of a sand box, saving the expense and labor of setting up and maintaining the ordinary types of water buckets and standards. A great saving is claimed for the scrubber through its ability to keep the pellets clean and white.

Golf-Ball Scrubber That Requires No Sand to Do Its Work and Saves Players' Hands

Armored Motorcycle Bank Patrol to Foil Bandits' Attacks

Armed motorcycle bank patrols have been established in Chicago to afford better protection for messengers and to discourage attacks from bandits. The men ride heavily armored sidecars with a steel compartment between the handlebars for carrying valuable packages and a shield to screen the passenger from bullets in front. Both the driver and his companion are armed, rifles, sawed-off shotguns and revolvers being included in their equipment. A reward of $2,500 is offered any member of the squad for each bandit caught or killed. The outfits are faster than automobiles.

How a Chicago Bank Has Answered the Bandit; an Armed Messenger Patrol Ready for the Streets

© U. & U.

Raft Is Floated High in Standpipe to Hold Wrecking Crew

In dismantling a huge standpipe, 144 feet high, in Beaumont, Tex., the tube was pumped full of water and a wooden raft was floated on the open top from which workmen operated acetylene torches to cut the structure to pieces. As each section was taken out it was dropped down the inside of the pipe. The level of the water was decreased as the cutting progressed, thus keeping the workers' platform within easy reach of their task. After about sixty-five feet of the standpipe had been torn down, it sprung a leak and the pump pressure was increased to overcome the waste and maintain the water at proper levels. Owing to the presence of several buildings at its base, the tower could not have been dismantled by other methods.

Small Radio Phones Fit in the Ears

Most radio fans agree that the headphones cause discomfort after they have been worn a long time and women often object to them because they disturb the hair. These, and other drawbacks are said to have been overcome successfully in a set being manufactured in England, in which small metal nozzles that can be slipped into the ears replace the usual type of rubber phone. Each receiver weighs only half an ounce. An outside permanent magnet is fitted to afford additional support to the phones, while the coils and diaphragm, concealed in a little metal case and an outer ring, are said to allow accuracy in adjustment. The set has a resistance of 3,200 ohms. A flexible cord with the usual plugs connects the pieces to the radio. These featherweight phones can be worn for long periods without fatigue, according to reports, and when not in use, are carried in a small leather pouch that fits in the pocket or handbag.

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Close View of One of the Phones, and How It Looks in Working Position

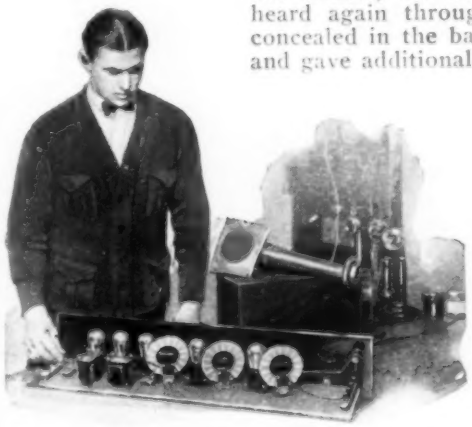
¶ Nearly 5,000 new ways of using gas have been devised in the last ten years.

Only a Filament Switch on the Rear of the Front Seat Is Visible on the Detroit Police Department's Controlless Radio Receiver

Radio—the Latest Crime Detector

Broadcasting Descriptions of Criminals Makes Every Listener a Potential Member of the Pursuing Posse

SOME thousands of radio fans were listening one night to a concert broadcast from station KOP of the Detroit police department. Suddenly the music broke off in the middle of a note and the announcer's voice was heard saying: "A murder has just been committed. We will now broadcast the description of the slayers." The details of the crime, as flashed to police headquarters by telephone and a description of the slayers and the car in which they had fled followed. The murder was hardly five minutes old when every radio fan for a hundred miles or more around had the details and knew whom to watch for. More important still, three big touring cars, cruising the city loaded with detectives and carrying an armament of riot guns, had picked up the same radio message, for all three carry five-tube receivers, so built that they pick up nothing but the police headquarters' broadcast.



Rear View of Controlless Receiver, Which Can Pick Up Police Headquarters' Broadcast Only

At the first warning, the police converged toward the route the escaping slayers had taken. As they sped through the streets, the announcer's voice was heard again through the loud speakers concealed in the back of each front seat and gave additional details. The slayers' car had been seen several blocks from the scene of the crime, where it had turned into a new route. The police cars shifted their courses accordingly. As minutes passed, each successive report was radioed to the police cars, and all along the route the slayers were taking, radio listeners deserted their re-

ceivers to hurry out and keep watch. Those who saw the slayers' car rushed in to telephone the news to headquarters, where the messages were relayed through the air to the pursuing police cars.

That is science's latest contribution toward hunting down the criminal. The hue and cry after details of a crime flash through the air arouse a volunteer posse that is ready with eyes on every road the criminals may take. The radio as a police aid is not a new thing, but broadcasting of the voice to millions of receivers has brought a new element into crime detection. It is not so far back, as years are counted, since two continents thrilled to the first wireless crime detection, when word was flashed from the S. S. "Montrose," outward bound from England to Montreal, that the missing Dr. Crippen and his companion were aboard. Some days later they landed in Canada, and not until they reached the dock were they aware that their identity had become known. Dr. Crippen paid with his life for the murder of his wife.

Several police departments now operate broadcasting stations and regularly put on the air lists of wanted persons and stolen automobiles. Hundreds of cars have been recovered, according to Detroit officials, through the daily broadcast of descriptions and numbers of stolen vehicles.

One of the most amusing radio police cases is described by W. J. Burns, former head of the bureau of investigation of the department of justice. A youth purchased a radio receiver, presenting a false order from a public high school. When the dealer found he had been defrauded, he called in a detective agency. That night a local broadcasting station read a message which described the boy accurately, even down to a small scar on his cheek, detailed the charge against him, and offered a $50 reward for his arrest. As expected, the boy and some of his friends were listening in. The next day his mother appeared and paid for the set.

Radio is also proving of value in identifying amnesia victims and locating missing persons. Not long ago a girl who had been in Cook County hospital at Chicago for more than two months, suffering from loss of memory, was taken to a broadcasting station and made a brief speech, asking anyone who might recognize her voice to identify her. A relative in St. Louis happened to be listening in, hurried to Chicago and identified the girl.

Relatives of missing people and police departments are turning to the radio to help find them. Hardly a night passes without one or more of the big broadcasting stations sending out an aerial SOS for someone who is wanted at home.

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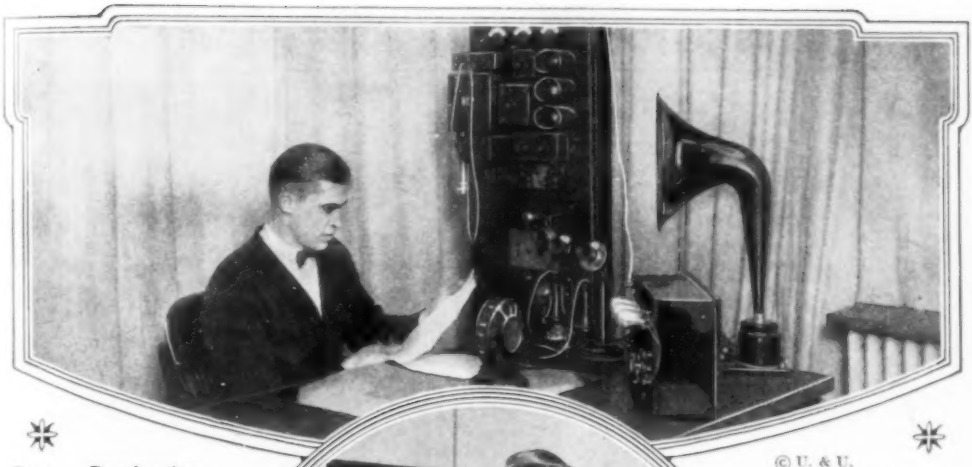
Frank F. Campbell, at Left, Wealthy Larchmont, N. Y., Business Man, Presented This Transmitting Set to Town Police Department to Increase Efficiency



Top, Broadcasting Police Bulletins from the Burlap-Hung Studio at Detroit Police Headquarters to the Shotgun Squads Patrolling the City in Radio-Equipped Riot Cars; the Police Radio Engineer, Shown Broadcasting, Perfected Controlless Receiver Which Picks Up Nothing But Police Station KOP; Receiving Sets Are Being Placed in All Police Automobiles in Philadelphia, and Lower-Left Picture Shows Assistant Police Director Elliott Listening In from His Car

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Left, Power Panel of Station WLAW, of New York Police Department; and Below, Transmitting Equipment of Detroit Police Headquarters, Station KOP, Showing One of Giant Tubes behind Screen Back of Meters

BABY "BLIMP" IS FITTED UP FOR AIR TOURING

Fishing from the Cabin of a Baby "Blimp," an Aircraft as Easily Handled as an Auto

Courtesy Goodyear-Zeppelin Corp.

America's first sky coupe, a pony "blimp" designed for air touring, is now being marketed. This tiny dirigible is 100 feet long, thirty feet in diameter, and has a gas capacity of 47,000 cubic feet. The ship, capable of a speed of fifty miles an hour, is driven by a sixty-horsepower motor and can maintain flight for twenty hours without refueling. It is as easily handled as an automobile. Service over both land and water can be rendered by the machine, and as it can be let down either on ground or water, it is said to be well adapted to the making of motion pictures, hunting, mapping, and as an aid to fishing fleets. The car has room for two passengers. Above it is a vent, about the size of a stovepipe, for controlling the pressure of the gas in the envelope above. The three-cylinder air-cooled engine is in the front of the car. Only one-fiftieth as large as the famed dirigible "Los Angeles," it has been predicted that the pony blimp may prompt the erection of public mooring masts, where drivers may tie them up, much as motorboats and launches are now docked. Long-distance overland cruises in fleets are also possible with the air yachts, and, as they are light and easily handled, they are well fitted for air regattas and racing contests similar to those held for water craft.

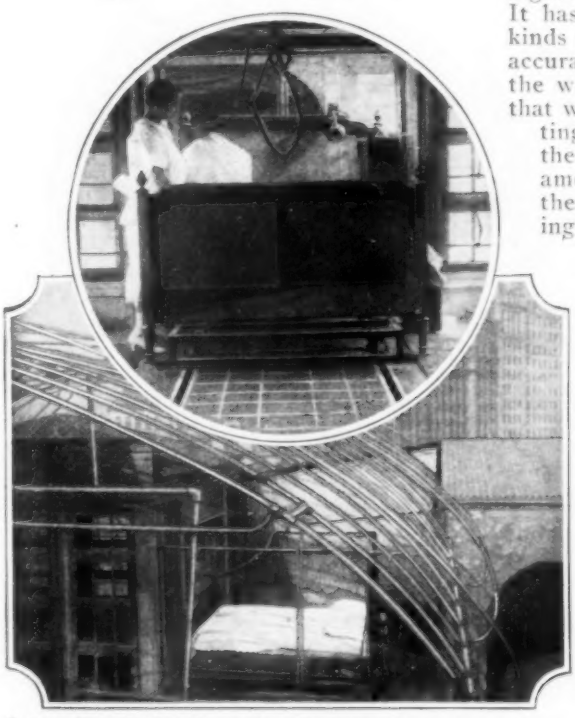
Great Lakes Gulls Cover World on Winter Flights

That gulls and terns inhabiting the Great Lakes region scatter over a wide range during their migratory flights has been indicated by a check-up kept on banded birds, according to William I. Lyon of the Inland Bird association, who marks more than 3,500 of the fowl yearly in an effort to learn their length of life, mating habits, and traveling ability. Even those reared in the same neighborhoods

of the northern climes have been found to follow different routes on their winter flights. A pair of terns, released after capture and banding in northern Lake Michigan, were trapped in Colombia, and another specimen taken along the Niger river in Africa, bore a marker which had been attached to it on the coast of Maine. Others identified by bands were found to have traveled from the Great Lakes to points in Georgia, Florida and Texas.

Bed on Rails on Top of Skyscraper Gives Air and Comfort

A bed that runs on rails can be moved from its room to an outside sleeping porch for the night when a control button, which turns on motive power and causes folding doors to open, is pressed. In the morning it can be returned to the inside by a similar operation, affording the sleeper the comfort of the warm room for dressing during cold or rainy weather. The control switch is so located that the occupant can set the apparatus in motion without leaving the bed. The device is installed in the private apartment of a fresh-air enthusiast at the top of one of New York's downtown skyscrapers.



Bed on Rails Which Moves from Its Skyscraper Room to Open-Air Porch When Control Button Is Pushed

Courtesy Field Museum

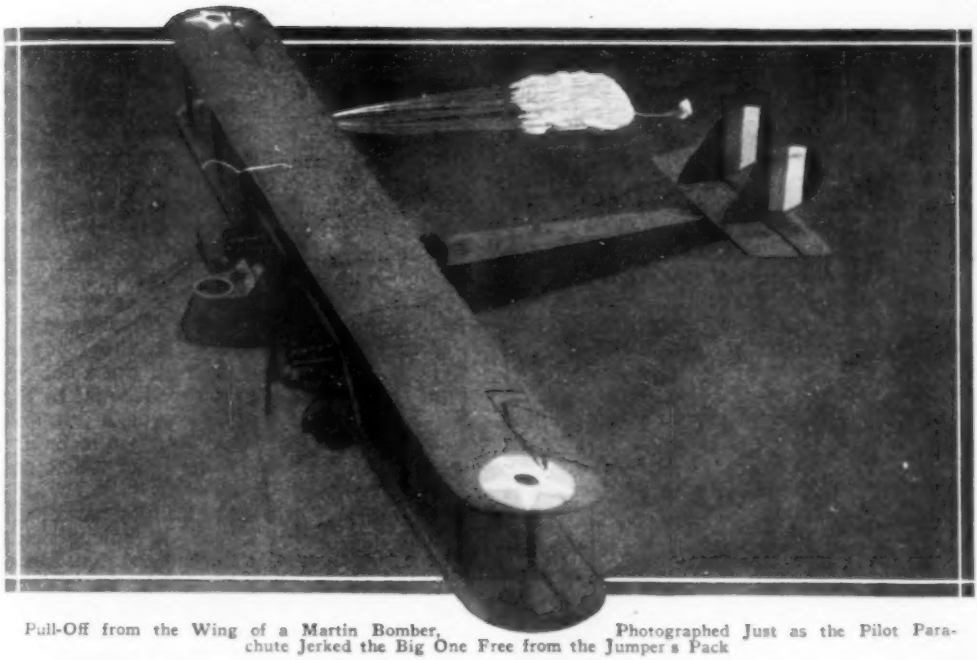
Pages of Weather History, Cross Sections of Trees Whose Rings Reveal Climate Conditions

Tree Rings Tell Weather Conditions and Which Way Wind Blows

Scientists of the Field Museum of natural history expect to learn what the weather has been like for 200 years or more in the vicinity of Chicago by studying the rings on oak and willow stumps. It has been found that trees of various kinds register within their trunks, a fairly accurate record of the seasons, because the wood that grew in the summer and that which grew in the spring can be distinguished in the annual rings. By these comparisons, deductions as to the amount of rainfall and sunshine that the trees received can be made. Carrying the study further, the microscope is expected to disclose what part of the wood was formed during cold, rainy and dry seasons, for the structure of the little sap tubes differs according to these conditions. Experiments and observations also have shown that the greatest growth in trees occurs on the side opposite to the direction of the winds. For instance, there are trees in Colorado in which the heart of the trunk is close to the bark on the side from which the prevailing winds blow.

¶ From Nov. 1, 1923, to the same date in 1924, 1,318 miles of new railroad were authorized and only 453 miles abandoned by order of the interstate commerce commission. The year before that, conditions were reversed.

Artist's Conception of Dramatic Leap of Two Airplane Pilots When Their Ships Collided Recently at Kelly Field, Tex., Showing Parachutes Just Opening to the Wind

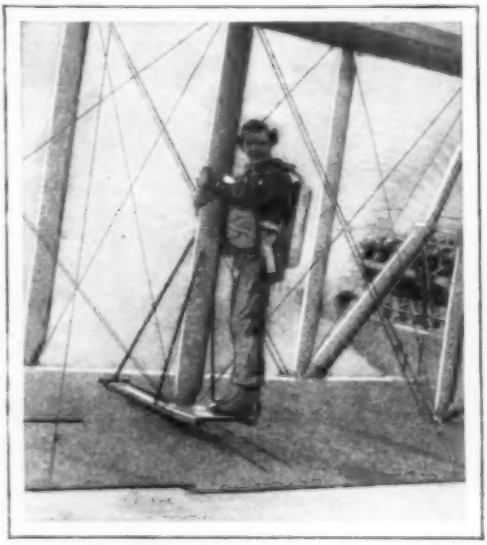


Pull-Off from the Wing of a Martin Bomber, Photographed Just as the Pilot Parachute Jerked the Big One Free from the Jumper's Pack

Falling a Mile for a Diploma

FOR unequaled simplicity in graduation exercises, the U. S. Army parachute school at Chanute field, Rantoul, Ill., probably takes the world's prize. To win the coveted diploma at the end of a six weeks' intensive course, the student is required to do but two things—and neither of them is writing an essay or speaking a piece.

Instead he folds up a parachute and takes his stand on the wing of a giant Martin bomber. The plane climbs a mile in the air, and, at a signal from the instructor, the student pulls the rip cord of his chute and is yanked off into space. Some two minutes later the ground rises up and bumps him—and the first half of his graduation exercises are over. The second half consists of refolding the parachute and taking a seat in the after cockpit of a DeHaviland plane. The craft goes up a mile, and at a signal from the pilot, the student climbs over the side of the fuselage, takes a deep breath, lets go of the ship, gives a lusty kick with his feet and falls backward into space. After sufficient time has passed to insure that he is clear of the airplane's tail, he pulls the rip cord, the parachute, if properly folded, opens, and some two minutes later the ground rises up and hits the student again. Parachute jumping is not dangerous, at least anyone connected with the school will tell you so, and some of them have jumped so many times they have lost count of the total. There is no loss of consciousness at any time during a jump, even on the first trial. The sensation, all jumpers agree, is



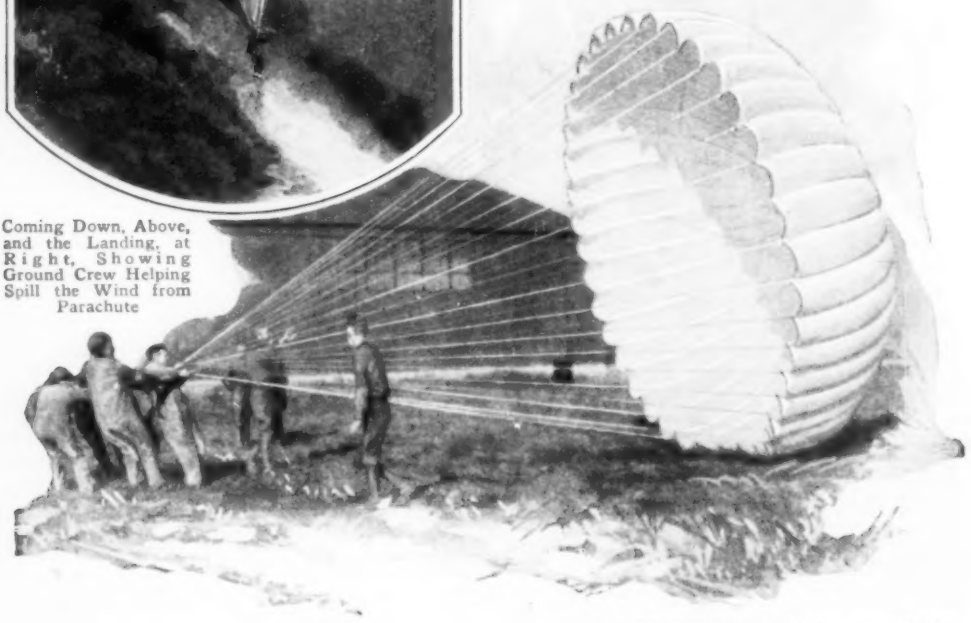
Standing on an Airship Wing Ready to Go Up for a Pull-Off; Exhibition Jumpers Wear Two Chutes

that of settling back into an incredibly deep and soft feather bed. No feeling of falling accompanies the drop, and when the parachute snaps open there is no jerk. Instead the harness tightens and the jumper, who is usually falling in a horizontal position or head down, is righted. A slow oscillation, like that of a giant clock pendulum, follows.

The distance from the waist belt on the jumper to the top of the parachute, when open, is thirty-two feet, so the man swings easily at the end of his supporting ropes. As the chute settles toward the ground the jumper has time to enjoy the view and call to those below. The only exciting part of the jump is the last 150 feet or so. Higher up the view is so broad that the jumper feels he is barely drifting downward, though his rate of descent is approximately sixteen feet per second. But when he gets within 150 to 200 feet of the ground, the earth appears to leap right up to meet him. His descent actually has grown no faster—the illusion is entirely mental. There is barely time to remember to draw up the feet and bend the knees for an easy landing when the thing is over.

The actual force of the fall—regardless of the height from which the jump was made—is about equal to jumping off a railroad flat car, or at least that is true on a calm day. If the wind is blowing, drifting the parachute before it, the force of the fall is equal to jumping from a flat car on a train moving at a speed equal to the wind velocity. In other words, a jump on a day when there is a twenty-mile breeze is equivalent to jumping from a flat car going twenty miles an hour.

The real thrillers among parachute jumps are those made in emergencies where the flyer was forced to abandon a crippled plane. The elect who have done that belong to aviation's most exclusive organization—the Caterpillar club. One of the most thrilling of all occurred in March of this year when two planes collided at an altitude of 5,000 feet over Kelly field, Tex., and both pilots leaped and land-



Coming Down, Above, and the Landing, at Right, Showing Ground Crew Helping Spill the Wind from Parachute

Official Photographs, U. S. Army Air Service

ed safely. The planes were part of a squadron of nine ships engaged in battle practice, chasing an observation plane. They were tumbling and circling around in a whirling maze—what the flyer calls a dog fight—when two of the ships crashed together with such force the wreckage remained locked. Cadet Charles A. Lindberg, piloting one, slipped off his safety belt and leaped. Lieut. C. D. McAllister, in the other ship, followed suit. Both pulled their rip cords after dropping several hundred feet and the parachutes opened. The wrecked ships shot past them as they fell and landed in a flaming mass. Strange to say, a few scratches were the only injuries received by the flyers.

The army parachute costs $620, measures twenty-four feet across when open, and is attached to the wearer by twenty-five stout silk ropes, twelve of the shrouds going down to one shoulder, where they are sewn in the harness, and thirteen to the other. The thirteenth is red, while all the others are white, the red one being used as a dividing mark in folding the parachute, and also to "spill" the wind out of it after a landing.

The harness is made of heavy linen tape, two inches wide, equipped with heavy iron rings, snap fasteners and buckles. The harness has a belt about the waist, supporting bands around each leg, crossed bands over the shoulders and down to the waist belt front and rear, and finally the double tapes on either side to which the shroud lines are attached.

Everything depends upon the way in which the chute is folded, and extreme care is taken to have it just right. The parachute is stretched out on a fifty-foot table, with the pack and harness at one end, and the little pilot chute hanging over the other, where it is held down by taking a turn around a peg. The pilot chute, two feet across, is built with ribs like an umbrella, but with a spring arrangement which causes it to fly open unless held under pressure. It is attached to the top of the big parachute, and is the last thing packed and the first out. When the rip cord is pulled and the pack opened, the little chute flies out, catches the wind and pulls the big parachute after it.

Water Craft Floated on Air Balls Is Rowed Like Canoe

A bottomless craft designed for water sport and held afloat by large inflated balls,

Air-Ball Water Craft for Use in Aquatic Sports Which Can Be Rowed with Paddles or Propelled by the Wind

is propelled by a large paddle similar to that used for a canoe. Owing to its light construction and buoyancy, little effort is needed to keep it in motion, and as it cannot retain water there is no danger of its being swamped in heavy seas. The apparatus may be employed by swimmers for exercising or can be used by beginners as an aid in learning. When traveling with the wind, the headboard acts as a sail and also as a fender against splashing of waves. For purposes of storage or transportation, the balls may be quickly collapsed and detached from the frame.

Compass for Ceiling of Automobile Can Be Illuminated at Night

A compass designed for attachment to the ceiling of closed-type automobiles can be placed in line with the driver's vision where it may be readily referred to. For night use, the face may be illuminated by turning a small thumb switch. The dial is hung so that it can not be deflected or unbalanced by the motion of the car. Its position does not interfere with the motorist's view and the instrument forms a valuable aid in deciphering directions on maps and route guides.

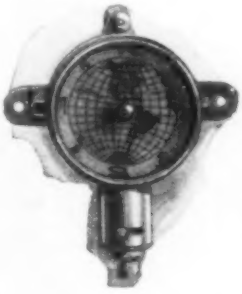


Photo Above © Ewing Galloway

Glimpses of Women at Work in Many Lands to Be Seen at the Chicago Fair, April 18 to 25, and Here Are a Few in Their Natural Surroundings, a Woman Farmer, Two Japanese Maidens Removing Raw Silk from Cocoons, a Java Woman Waxing a Pattern on Cloth for Dyeing, and Below, a Navajo Indian Blanket Weaver

Woman's Work in Many Fields Shown in World's Fair

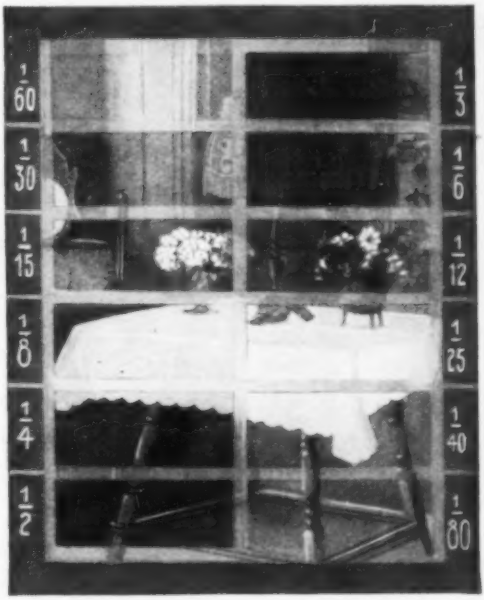
What women have achieved as inventors, builders, managers and in many other fields since the beginning of the twentieth century will be shown at the Woman's World's fair in Chicago, the first international exposition of its kind ever held. Its purpose is twofold: to review attainments in the new activities in which women have taken part in recent years, and to give information concerning various vocations and help in obtaining employment, if desired. The idea of the exposition was originated by Miss Helen M. Bennett, manager of the Chicago collegiate bureau of occupations, and was directed by a board composed of prominent Chicago women. Booths in a large exhibit hall will be devoted to products gathered from many lands to show women's skill with machines and hand implements. One will be given exclusively to women inventors, some of whom will be present to demonstrate their creations. Attendants in colorful native costumes will display the foreign wares. Nurses and welfare workers will illustrate the services they have rendered on battlefields and in cities; women athletes, architects, mechanics and experimenters in radio will share in the review. Several foreign nations are expected to participate through their consulates and many women prominent in state and national politics will be guests.

Bathing Cap with "Ear Pockets" Has no Buckles or Seams

"Ear pockets" are provided on a bathing cap as a means of protecting them against the entrance of dirt particles and the pressure of water. The headpiece fits the wearer snugly and has no buckles or seams to interfere with comfort. Once in place, the gear is claimed to be proof against loss. A similar guard is also designed for wear underneath the ordinary cap, preventing the outer covering from slipping off in the water, and keeping the hair in place and free from moisture.

Exposure Meter for Photo Prints Saves Waste of Paper

For both the amateur and professional photographer, a meter which determines



Print from Exposure Meter, Showing Different Degrees of Development and Time-Gauge Figures

automatically the right exposure for prints on bromide or gaslight papers, is said to avoid wasting of material and assure better results than can be attained by guesswork. It is simply a small piece of film, bearing photographic images of twelve different tints of successively deeper tones. To use it, the meter is placed between the negative to be printed and the paper. When the exposure is developed, it will show a series of light and dark shades from which the one most satisfactory may be chosen for the rest of the prints. On the margins opposite the different gradations, are fractions for the guidance of the photographer. For instance, the test has taken forty-eight seconds and the best result corresponds to the shade produced next to the one-twelfth mark. Dividing the time by the divisor of this fraction gives four, the correct exposure in seconds for succeeding prints, if that degree of development is desired. This tester gives equally good results for thin, fogged and almost opaque films or plates, and can also be used in enlarging where further saving is effected as only a small piece of paper is needed. On this work, the meter is pinned to the easel, in front of the paper.

Radio Set Concealed in Doll's Body Makes Toy Lifelike

Concealed in the body of a large lifelike doll, a three-tube radio receiving set

Copyright, Underwood & Underwood

Radio Doll Which Conceals Three-Tube Receiver and Can Be Carried About While Operating

equipped with a loud speaker can be carried about while in operation. The toy may be placed in a sitting position on a chair or table making an attractive ornament as well as providing entertainment. Dials for tuning in the set can be easily reached for adjustment and in case of needed repairs or inspection, the head of the doll may be removed to uncover the loud-speaker mechanism. Protection has been provided for the more delicate parts of the machine so it can be operated outdoors in any kind of weather.

New Base for Tower of Pisa to Stop Further Leaning

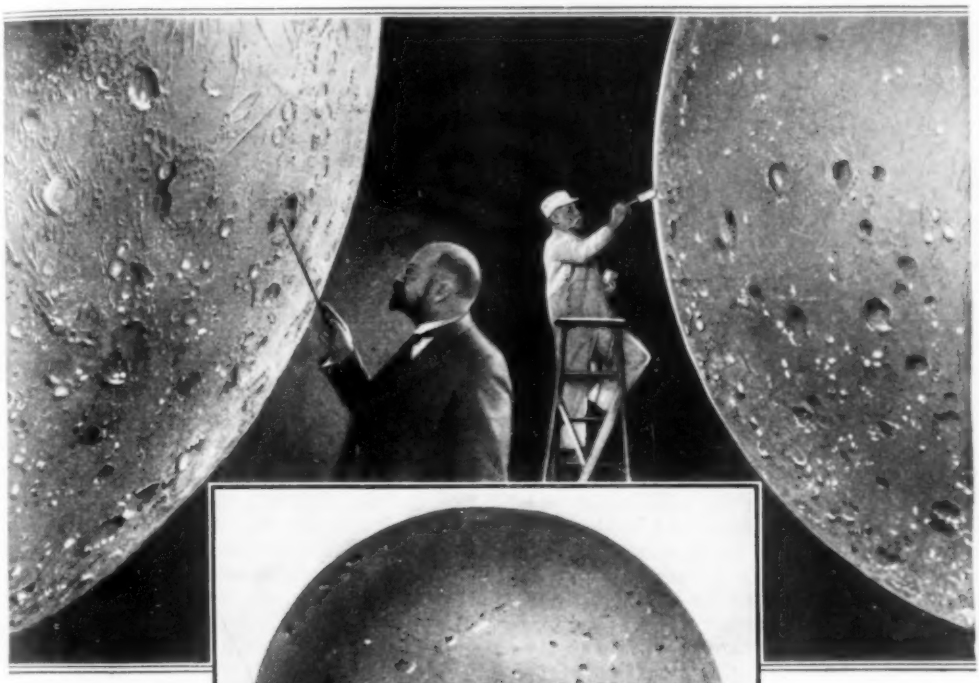
Pisa's leaning tower is now so far out of plumb that engineers fear for its safety and the Italian government has appointed a commission to take steps to anchor the structure from further slanting. In this wonder in marble, Galileo, the great astronomer, is said to have solved the riddle of the pendulum, the secrets of the speed of falling bodies and invented the telescope. Some of his theories, it is said, he never could have proved but for the way the tower leaned. It is now reported to be more than sixteen feet out of vertical, having added nearly a foot to its inclination in the last 100 years. It is fifty-three feet in diameter at the base and 180 feet high and rests on foundations only ten feet deep and no greater in circumference than the tower itself. The tower harmonizes with the architecture of the great cathedral near by and was built to rival the famous campanile of Venice. In the eighth story is a set of bells.

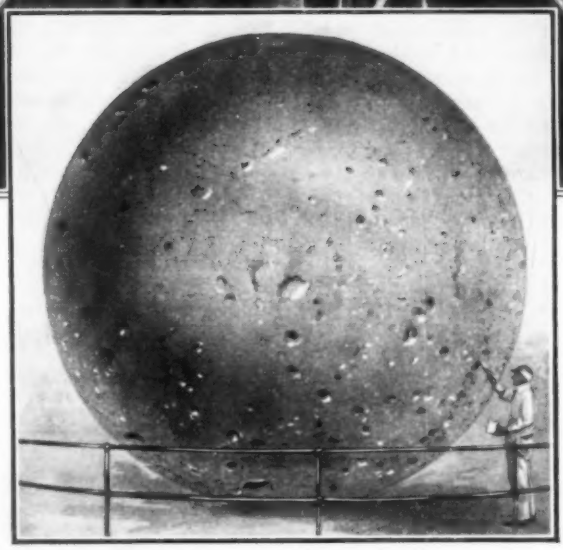
Quick-Action Stand for Motorcycle Operated by Rider's Foot

To hold a motorcycle firmly erect when the machine is at rest, a quick-action folding stand has been patented for attaching to the footboard frame. As the vehicle comes to a stop the brace can be pushed down by a slight movement of the rider's foot so the machine can be supported on the stand and its wheels. When the cycle is started again, the holder may be snapped back against the frame with a touch of the driver's heel. Used by policemen, messengers, and other motorcycle riders called upon to stop frequently, the device saves time occupied by setting the vehicle in position and eliminates the need of lifting or pushing the heavy machine onto the ordinary stands to hold them upright. In parking, the cycle may be easily moved about on its wheels without raising the footboard brace which can not be damaged in "spills" or cause accidents, should the rider neglect to fold it up when starting off.

Quick-Action Motorcycle Stand for Manipulation by Rider's Foot; Insert, Folded Up against Frame

MODELERS MAKE LIFE MASK OF MOON FOR MUSEUM





Two Detail Views of Craters and Mountains at Model's Edge and Entire Face, Illustrating Relative Size to Human Figure

How the moon looks when seen through a powerful telescope is shown in a large model in the Field Museum of natural history. It portrays 20,000 features so that in a few moments, a visitor can see about all that scientists have been able to learn of the shape and location of formations on the satellite's surface after centuries of study. Peaks of the mountain ranges, the jagged edges of what are believed to have been the mouths of volcanoes and the barren, pock-marked stretches, the "seas," are all accurately represented on a plaster coating over a rigid spherical framework of steel beams and wood, nineteen and two-tenths feet in diameter. Three years of research and modeling from actual photographs were required to complete it. Noted astronomers carefully checked all details before it was placed on exhibition. It is painted in light blue and yellow, and floodlights are installed to give it a more natural appearance and to emphasize the shadows of the peaks and depressions. The model was made in Italy, shipped to this country in sections and assembled. Charts and lettered photographs of the moon have been placed near it for the guidance of visitors.

Broadcasting Power Is Inexpensive

At a recent forty-five-minute program broadcast by WHA, the University of Wisconsin, it was calculated that the cost was only three cents. This figure represented only the actual cost of the electricity consumed, no other items such as the depreciation of the apparatus being taken into consideration.

Adjustable Auto Truss and Jack Saves Time and Labor

Replacing the wooden horse and blocking ordinarily used to support automobiles

Hoisting Auto with Steel Truss Used as Jack While Inserting Another to Support Load

undergoing repairs, an adjustable steel truss has been constructed which also serves as a jack. The device is suitable for any car and may be set for any desired height. The head is designed to fit the axles without interfering with any operations on the running gear and leaves ample clearance for the removal of the parts. With the addition of a wooden lever, one truss can be employed as a jack to raise the car, while others are used to bring the load to the necessary level.

Animal Increase Held Due to Sun Regularly Changing Its Spots

Many million miles separate the spots on the sun from a rabbit, but scientists declare that there is a connection between them and that the periodic changes in the number of dark masses on the sun's surface partly explain certain facts concerning the growth of plants and animals. Records of the spots have been kept for 150 years and it has been found that they increase to a maximum about every eleven years. This high point is accompanied by a low-temperature period on the earth, it is said, while fluctuations in atmospheric pressures, rainfall, tracks of storms in North America and the rate of growth of the redwood trees are all declared to correspond to the changes in the sun-spot numbers. Records kept by the Hudson's Bay company since 1845 are said to show that the number of rabbit skins received reaches a high mark at a time when the sun spots are at a minimum. The sunlight is believed to have a direct influence on one of the vitamins in the food the animals eat and thus affect their numbers. Due to a climate fluctuation of unknown cause, every three and one-half years, a small arctic animal, known as the lemming, attains vast numbers and hordes of them migrate to the lowlands, and even into the sea, dying by the thousands as they plunge into it.

Records of Radio Announcer's Voice Aid Speaker to Correct Faults

To help radio announcers to correct any faults of speech which might affect clearness while broadcasting, an instrument records and reproduces their voices as heard "on the air." Since by the machine speakers are enabled to hear themselves, they can detect any defects of which they may not be conscious. It is expected to employ the device in a course of training for radio announcers as well as to assist in perfecting a system of standards to be followed by those doing vocal broadcasting. Records of announcements from various stations are intended to be made with the instrument during a period of two weeks and can be run off in about an hour.

Recording Apparatus Which Reproduces Voices of Radio Announcers for the Purpose of Correction and Training of Broadcasting Speakers

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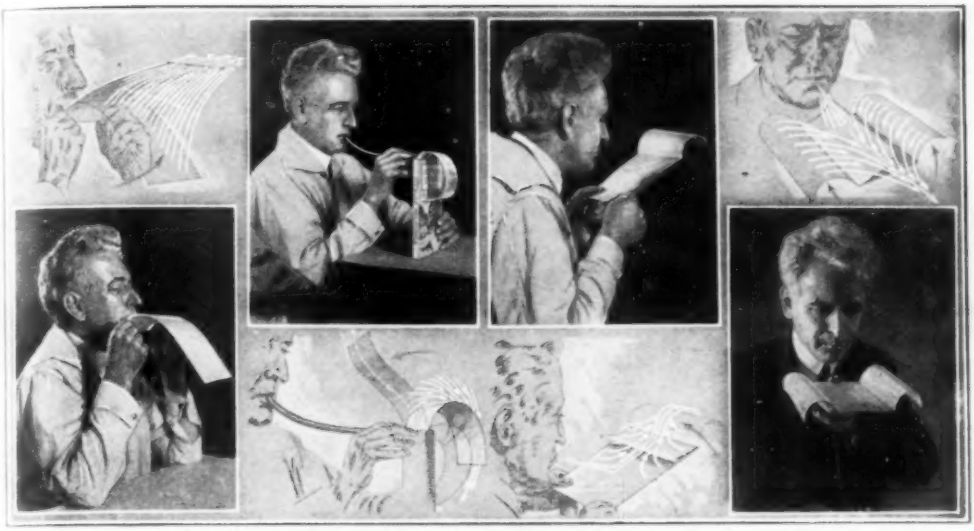


Playing with Air Shows New Laws to Aid Aviation

Simple Experiments You Can Do at Home

DISCOVERIES which he hopes may revolutionize the art of flying are claimed by C. H. Keefer, an inventor who has devoted nearly thirty years to studying wind currents.

Starting with the theory that the propeller type utilized for both ships and airplanes is scientifically wrong and inefficient, and that if man properly understood the secret of the flight of a bird or a fly he too could build an airship designed like a bird's body, to fly without wings, Keefer is working on a radically novel propeller, on which patents are pending. His theory is that the bird's wings only partially sustain it in flight, thus differing from the planes of an airship—except when the bird is gliding. At other times, he believes, the duties of the bird's wings are to draw a partial vacuum above the wing by the downward stroke and to fan the air backward, creating a partial vacuum ahead of the bird, and piling up an increased air pressure behind it. This increased pressure, he says, exerts a forward push under the tips of its feathers, and thus drives the bird through space. The trouble with present airplane designs is twofold, according to Keefer. Most propellers used, he says, are only effective in the region near their tips, and if run at very high speed will thresh through the air without developing any thrust. Also there is always a vacuum following their blades around, requiring considerable expenditure of power to overcome the drag. In addition to the faults of the propeller, the wing design, owing

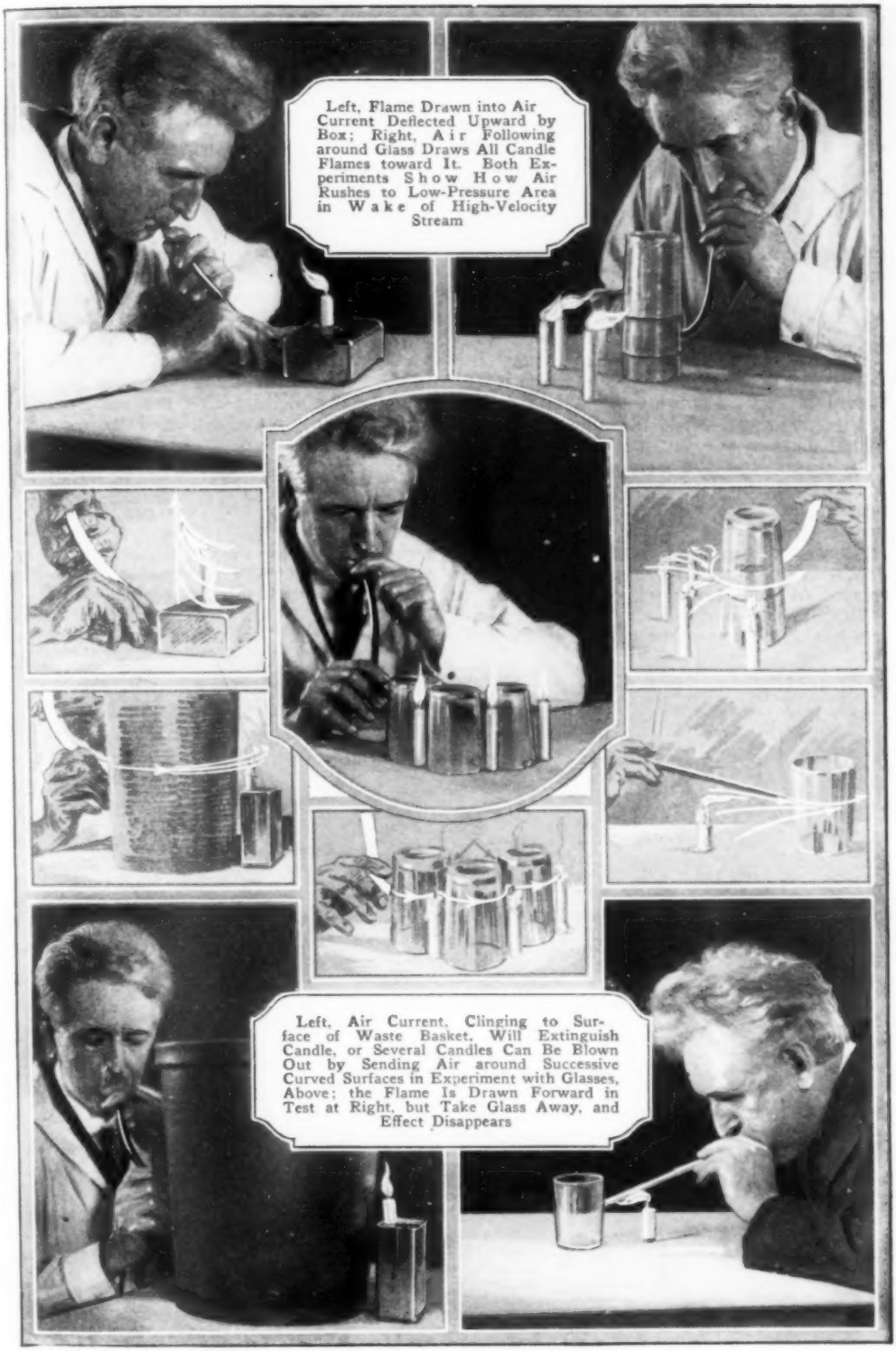
Simple Experiment, Showing Force Exerted by Air Stream Clinging to a Curved Surface

Blowing against Metal Disk, at Left, Makes It Cling to Tube and Revolve; Blast on Front Disk, in Center, Causes Rear Disk to Move toward Blower; Right, an Unusual Propeller

to head resistance, uses up considerable power in pulling the wings through the air, while the thin trailing edge of the back of the wing lets the wind currents slip off without returning any power.

Therefore he has tried to develop a type of propeller employing the air forced backward to push the ship forward, which would utilize the trailing vacuum behind its blades, and therefore need less power, and which would pack the air forced backward on the surface of the ship, so that there would always be excess pressure behind it to push forward into the vacuum created ahead of the propeller. By a simple experiment he demonstrates that an air current, when driven at increased velocity over a curving surface, follows around the curve. Take an ordinary water glass, a candle and a small tube. Light the candle and place it on one side of the glass, then hold one end of the tube against the glass from one-half to two-thirds the way around from the candle, and blow through it, the angle of the tube being such that the air current will be forced against the glass. Instead of being deflected from the glass, the air current will follow right around its curve and blow out the candle. Blow on a level with the flame to extinguish the candle; otherwise the flame will bend toward the air stream and cause the air to appear to be deflected from the glass. The reason for its peculiar behavior is due to the fact that the atmosphere has a normal pressure (at sea level) of about fifteen pounds per square inch, while there is no corresponding pressure in the space the glass occupies. Therefore the air current is pressed tight against the surface of the glass by the atmospheric pressure, and travels around the line of least resistance. This peculiarity of air in following a curved surface is utilized in many of Keefer's experiments. One of the simplest is made with an ordinary sheet of paper. Hold it so that it remains flat and blow across the surface. No movement results. But let the paper hang down, holding it by the corners nearest the face, and then blow. The air current follows down the curve, decreasing the pressure there, and the ordinary air pressure below the sheet will lift it up.

Next, Keefer puts a fold in the paper, two or three inches from the end farthest from his face, and then, by drawing the folded part down over the edge of the table, gives it a curve. When he blows across the paper the air current travels across the flat surface and up and around the curve, with the result that the curved flap is forced up and toward the blower by



Left, Flame Drawn into Air Current Deflected Upward by Box; Right, Air Following around Glass Draws All Candle Flames toward It. Both Experiments Show How Air Rushes to Low-Pressure Area in Wake of High-Velocity Stream

Left, Air Current, Clinging to Surface of Waste Basket, Will Extinguish Candle, or Several Candles Can Be Blown Out by Sending Air around Successive Curved Surfaces in Experiment with Glasses, Above; the Flame Is Drawn Forward in Test at Right, but Take Glass Away, and Effect Disappears

the air pressure underneath. It flaps back toward the blower in seeming violation of all the popularly accepted ideas about air and its forces.

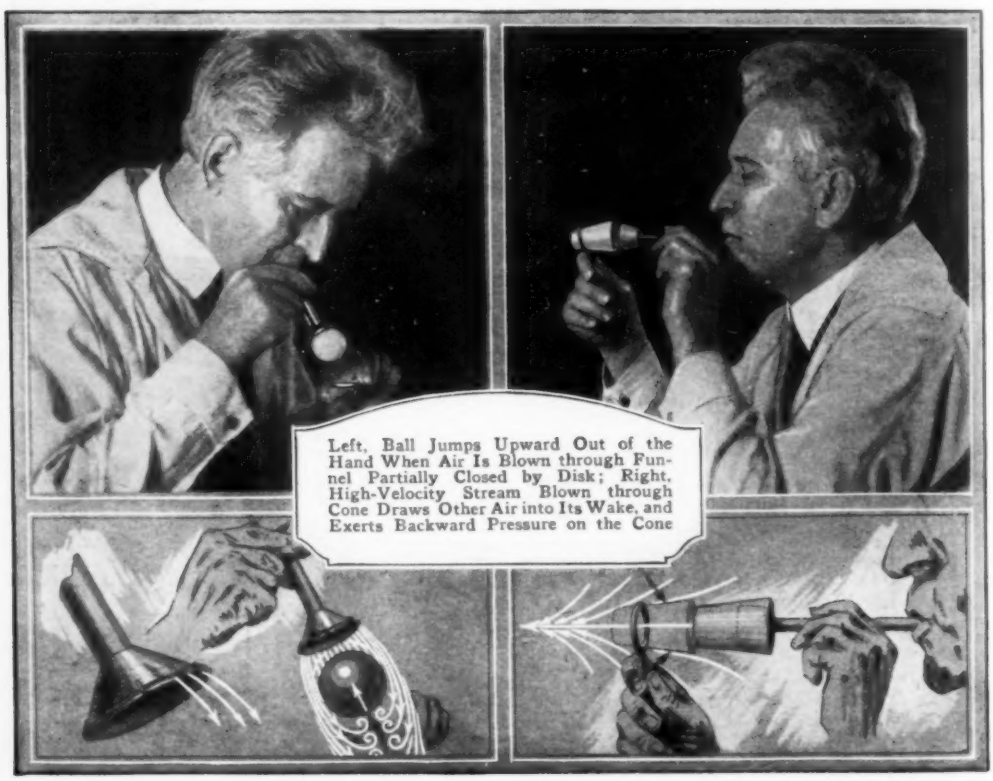
From there, his experiments progress to a sheet of paper with folds and similar curves in both ends. When he blows down the flat surface between them both flaps are flipped over and toward the center of the sheet, where the blown current at higher velocity has decreased the pressure. His paper experiments form an endless and fascinating series.

Take a strip of paper, three inches or so wide and ten or twelve inches long. Fold it about three inches from each end and draw the part between the folds over the table edge to give it a curve. Place it on the table and hold the nearest end down with one finger, while blowing a current of air across the flat surface. The air goes up around the curve and in its effort to continue that movement, being pressed in by the atmosphere, it compresses the curved section and draws the farther flat surface toward the blower, producing a complete reversal of the direction of movement.

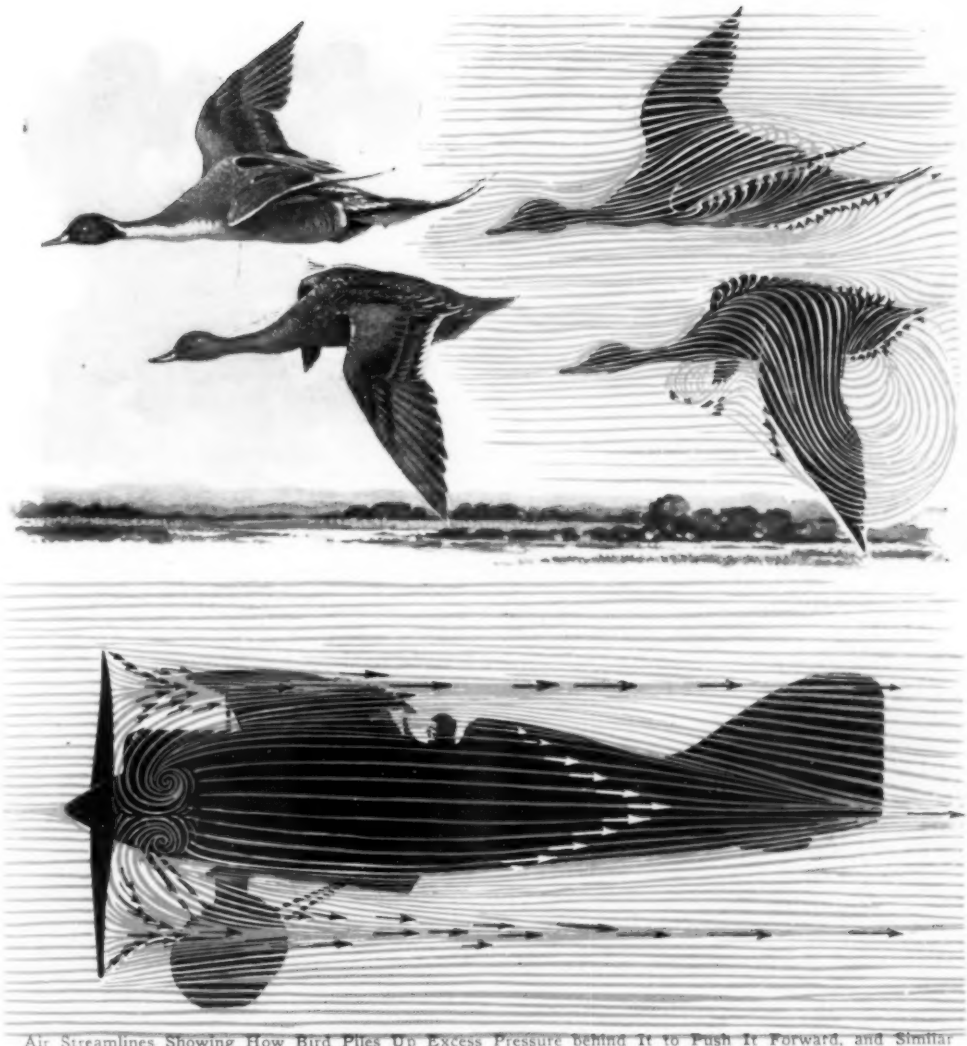
Next place a lighted candle just beyond the farther end, and hold that end down also with one finger. Blow through the tube and the air current follows over the curved hump, but, since the loose end is held down and cannot move, the current continues on and snuffs out the candle. Then relight the candle, let the farther end of the paper remain free, blow, and the paper will again move toward you, while the candle remains lighted.

The lighted candle can be used in many ways to demonstrate the peculiarities of air currents. Place it on a book or small box, two or three inches high, and back three or four inches from the edge nearest you. Then, with a small tube, blow against the base of the box or book. The air current is deflected straight upward along the side of the obstruction, and on up into the air, drawing the surrounding atmosphere toward it, and the candle flame toward you.

Another interesting experiment by which Keefer demonstrates the influence of high-velocity air currents when deflected is made with a piece of wire and two metal disks of the same size. The wire is bent in the form of a rectangle, with both ends twisted together to form a handle. One disk, strung on the wire, is soldered firmly to the end nearest the



Left, Ball Jumps Upward Out of the Hand When Air Is Blown through Funnel Partially Closed by Disk; Right, High-Velocity Stream Blown through Cone Draws Other Air into Its Wake, and Exerts Backward Pressure on the Cone



Air Streamlines Showing How Bird Piles Up Excess Pressure behind It to Push It Forward, and Similar Lines Demonstrating How an Airplane Wastes This Force

handle, and the other, with a small piece of metal tubing stuck through the center to keep it sliding easily, is strung on the upper horizontal wire of the rectangle. Holding it in front of him and blowing against the fixed disk, he causes the second movable disk to slide toward him. The air blown against the fixed disk is deflected outward, its increased velocity being accompanied by decreased pressure, and all the surrounding air rushes in to fill the void. The rush of air carries the movable disk along the wire toward the blower. Stick four candles up in a semicircle, and place a glass inside the curve they form, so that it stands two or three inches from each candle. Then, with the tube, blow an air current around the glass, and the candle flames are all drawn toward it. Next place three or four glasses in a row, touching or nearly touching, and fix a lighted candle in the curve between each pair of glasses, and beyond the farthest one. Blow the air current on the first glass and it will follow right around each glass, snuffing out all the candles.

Still more interesting demonstrations are made with a small celluloid ping-pong ball, about an inch and a half in diameter. Hold the ball above the end of the rubber tube and blow on it and you can drive the ball up into the air, where it will bounce about on the invisible air column as long as your breath holds out.

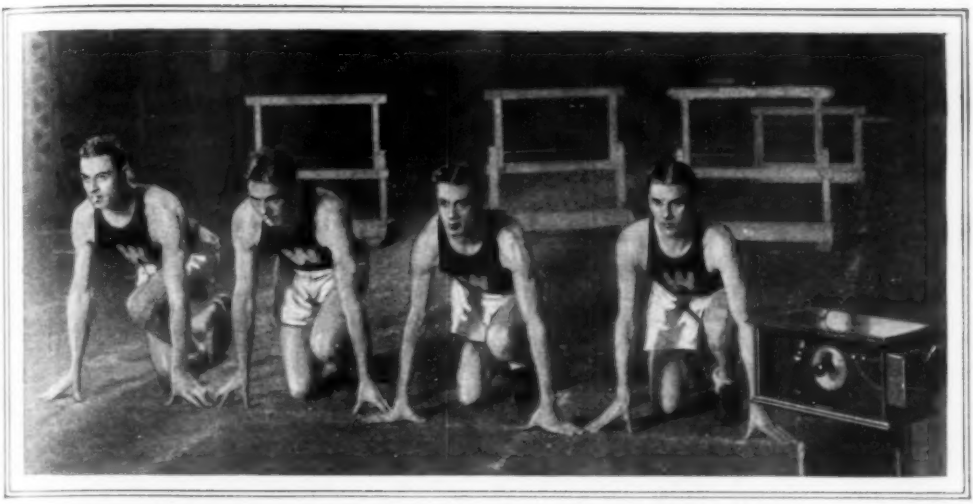
Next hold the ball against the wall, and blow against it, through the tube, and the ball will stick to the wall, moving about as you move the tube. The first of these is an old experiment, but he has another which is of his own invention. Soldered to the end of a small copper tube he has attached a little copper funnel, the sides of which form a ninety-degree angle. Inside the end of the funnel is a cup-shaped copper disk, fastened to the funnel by three soldered wires. When he blows through the tube the air is deflected by the disk and passes out the sides of the funnel, the air currents on opposite sides being at ninety-degree angles with each other.

As soon as the ping-pong ball is held three or four inches below the funnel the situation changes, however. There is no air pressure in the space occupied by the ball, so the atmospheric pressure drives the air current from the funnel in toward the ball's surface, and once there the currents follow around its curves and the ball jumps out of his hand and clings to the funnel above.

Another demonstration, which has possibilities as an interesting parlor game, can be made with a glass, the ping-pong ball and the tube. Place the glass on one side of the table and the ball two or three feet away. Hold the tube so its end will direct an air current forward on the side of the ball nearest you, at a slight angle just above the center. Blow, and the ball will rise in a graceful arc and fly over toward the glass. A few experiments to get the angle and determine how much wind you need, and it is possible to drop the jumping ball into the glass. The jumping shot is familiar to billiard players and golfers, but that the same thing can be done with no more material aid than a current of air may be new to most of them.

As the result of his years of experimentation Keefer evolved a simple propeller consisting of four tin blades stuck into a cork, which was free to revolve on a pin. The little blades were bent in a semi-cup shape. If one were to hold the cork propeller in front of himself to blow against the blades, to all appearances their cup shape would catch the air and cause the cork to revolve to the right, or clockwise. But blow against it and just the reverse happens, for the cork turns in the opposite direction to the clock. In other words, when air is blown against it, it revolves in the same direction that it would if propelled by a motor behind it.

An Amusing Parlor Game of "Jumping Ball" in Which the Light Ping-Pong Ball Is Drawn into the Skillfully Directed Air Stream and Literally Jumps from Table into Glass



Track Runners Awaiting the Starting Signal from a Mechanical Pacemaker Which Assists Athletes to Judge Their Speed and Keep Up with Records and Schedules for Training

Coach Invents Pacer for Runners So They Can Judge Speed

To train track athletes to judge their running speed, a mechanical pacemaker in use at the University of Wisconsin sounds a bell at regular intervals to mark the time allowed for racers to cover various distances. With its assistance an athlete engaged in practice sprinting can tell whether he is traveling behind or ahead of schedule. The pacer, which can be handled as easily as a suitcase, may be adjusted to sound time signals at determined periods up to 100 seconds in length, and may be used for either short dashes or long-distance running. The machine, on which the inventor has worked for about two years, was built in the university shops.

Electric "Insect" Welds Steel

For welding piping, steel plates of ships and many other articles, an electric "sewing machine" known as an "insect" because it resembles a fly in appearance, is reported to have a capacity of thirty feet an hour. It is said to knit the pieces together by means of white-hot steel wire fed from a bobbin and passed under a powerful arc to help form the weld.

Vacuum Cleaners for Army Mules Save "Skinners" Time and Work

"Mule skinners" in Uncle Sam's army are relieved of considerable disagreeable work by using electric vacuum cleaners for their charges instead of the familiar currycomb and brush. The outfits have a dust bag, hose and nozzle specially shaped for the task and are carried by a strap about the attendant's waist. Dirt and loose hairs can be removed quickly and it is said the mules seem to enjoy the treatment fully as much as an old-fashioned scraping. The cleaner is operated from the camp lighting circuit.

"Policing Up" an Army Mule with Vacuum-Cleaner Outfit That Is Replacing the Currycomb and Brush

Fire Fighting on the Waters

Boats That Have Feet and Powerful Pumps Guard Rivers and Harbors in Our Cities

CAPABLE of throwing as much water as twenty engines, independent of city mains and ready at any second to speed to the scene of a conflagration, a modern fireboat is one of the most efficient units enlisted in the endless battle against flames.

Stationed along city harbors and rivers where property can be only partly protected by street apparatus, a boat's powerful pumps can hurl twenty or more streams simultaneously at the rate of 10,000 gallons a minute at a pressure from 200 to 300 pounds, depending upon the size of the nozzle.

The boats carry several thousand yards of hose to assist street companies, should the fire be three or four blocks from the shore. A good fireboat costs a quarter of a million dollars, but some of them have more than paid for themselves in damage prevented at one fire. New York has eleven boats, Chicago four and other cities with navigable streams have several.

A fireboat looks like an overgrown tug. On its low, steel-floored deck toward the stern are two standpipes each capped with a brass nozzle, the boat's water "guns," and below are the gates, nine on a side, where the hose lines are attached. What strikes the eye first, though, are the craft's "feet." These are pointing up in the air like the barrels of enormous fountain pens, being known as spuds. Each is raised and lowered by a separate steam winch. When the boat is at a fire, these feet are let down into the mud to keep the craft from drifting with the current or pressing against the banks, thereby cutting off the water supply from the intakes. A typical electrically driven boat, such as the "Graeme Stewart" of Chicago, is 122 feet long of 309 tons' weight and has two motors of 250 horse-

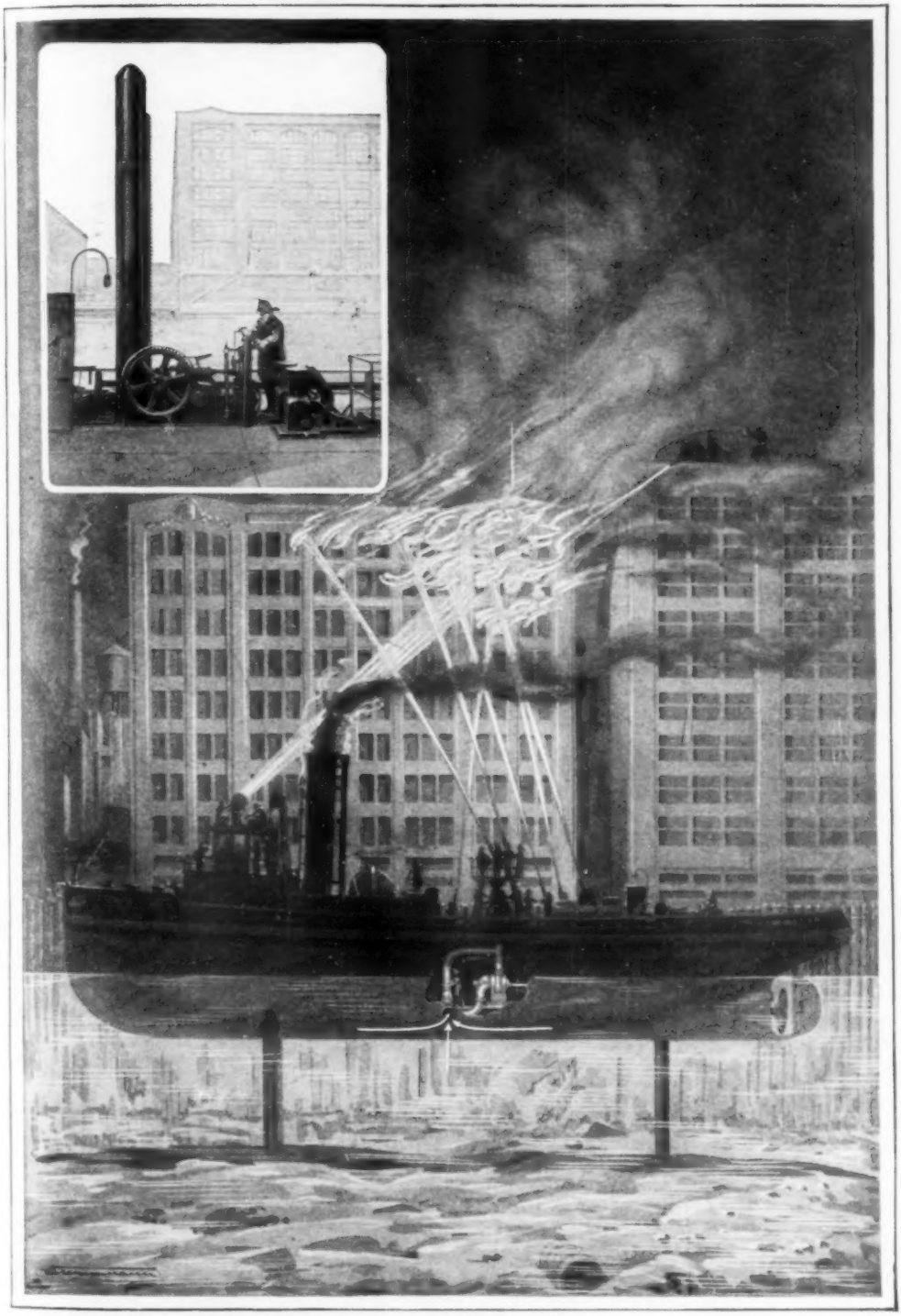
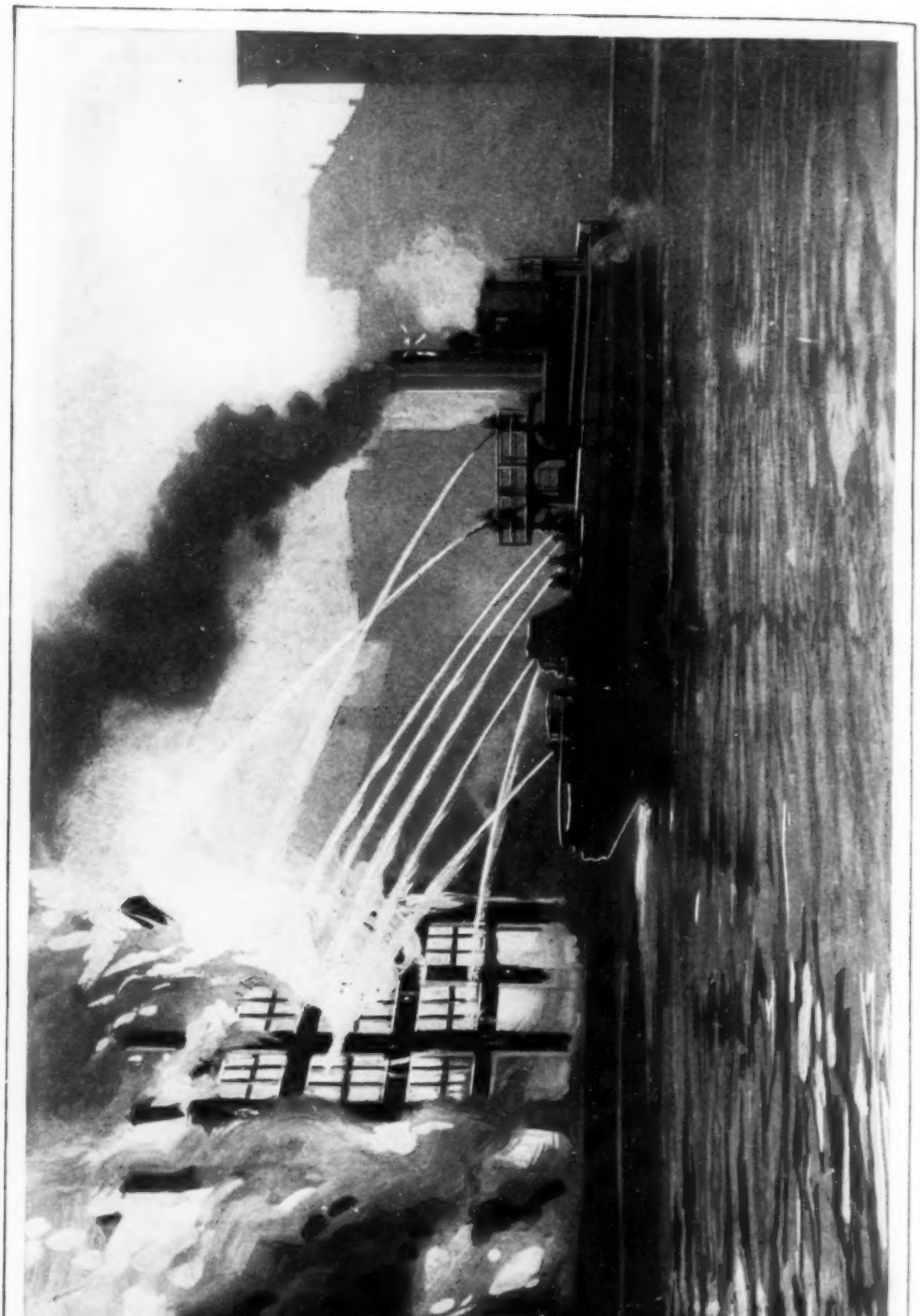


Diagram of Boat at Fire, Showing Feet Lowered into Bottom and One of the Water Intakes; Inset, Spud Elevated above Deck and Fireman at Winch That Operates It



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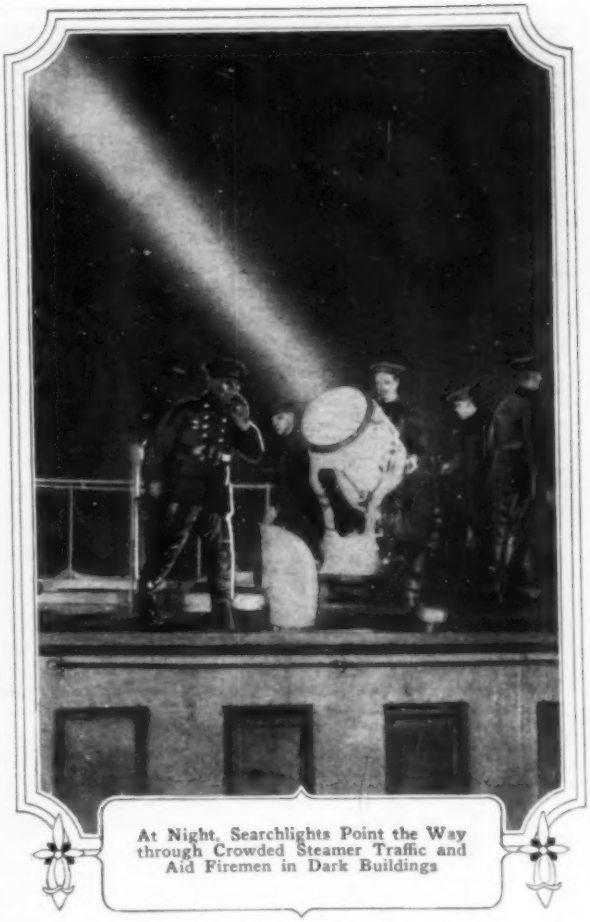
power each, directly connected to the propeller shafts. Power for the motors and for the pumps, with an individual capacity of 4,500 gallons per minute, is furnished by two turbine generators supplied with steam from two boilers of the marine type, in which a pressure of 140 pounds is maintained night and day and 170 pounds when fighting fires. These units are arranged in pairs, one on each side of the ship, and beside them are condensers, vacuum pumps and an exciter for the turbines, which also supplies electric light for the boat. The boat is known as a one-man control type, that is, it can be manipulated entirely from the pilothouse or from the engine room, saving the necessity of repeated signaling. A switchboard control furnishes a cut-out preventing interference from either.

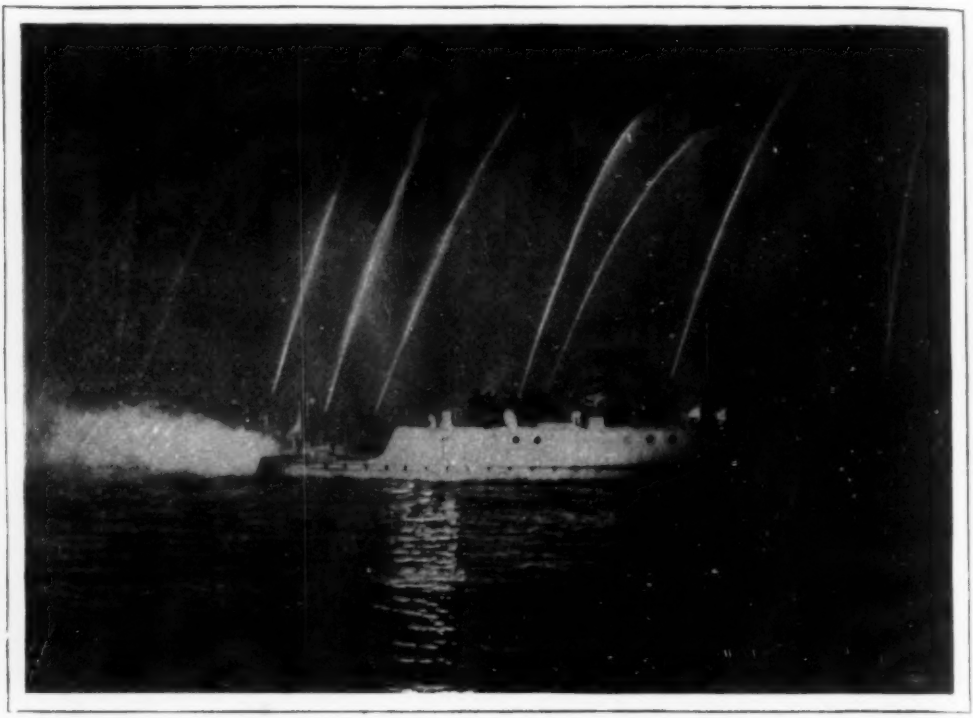


At Night, Searchlights Point the Way through Crowded Steamer Traffic and Aid Firemen in Dark Buildings

Like other units of the department, a fireboat must answer all engine calls within its district. At quarters, a bunk room and living room a stone's throw from the boat, where the crew of twenty, ten for night and ten for day service, eat, sleep and amuse themselves when not on duty, is the usual assembly of fire-alarm instruments. These are connected to the central alarm station from which calls are relayed from the street boxes. There are the telephones, the telegraph "joker," used to signal the different companies, and the ticker, a glass-inclosed mechanism that records the number of each fire-alarm box "pulled," by tattooing dots on a narrow strip of paper as it jerks out of a little opening while a bell rings. The number of the box is repeated four times, by the bell and the dots. On a wall is a chart showing the box numbers and street location of each for the district, a list of the department's code calls and other station numbers; and in a drawer below, a card-index system for the entire city, giving the location of every box and the numbers of the engine companies that respond to the first and successive calls.

What happens when a box is pulled in the district patrolled by a fireboat? The instant the glass is broken or the hook pulled down, an electric circuit is completed, registering the alarm and its location at the central office whence it is relayed to the fireboat's quarters. Perhaps it is box 314. "Ding, ding, ding," then a slight pause; "ding," another pause; "ding, ding, ding, ding," followed by a longer pause, and then the same thing over again three times, clatters the bell while the tape comes inching out of the case, bearing its tattoo that tells the number of the box. Before the number is repeated, the man on watch, one of the crew always on duty near the instruments, has caught it and so have the rest. The peaceful room snaps into action. Down come feet from the stove and radio headphones are torn from ears.

"It's a go," sings out the captain who has been making out his report, and every man is headed for the stairs as a big brass gong explodes with a furious din in the bunk room, the signal that rouses the crew at night. Perhaps the pilot and the engineer are the only men on board the boat. The pilot has heard the clatter and is on the alert. "Three-fourteen," shouts the captain as he reaches the gangplank. The



Night Demonstration of Fireboat Brigade on the Thames off Battersea Park to Show How Streams Can Reach Tall Buildings when Flames Imperil a Dock Front

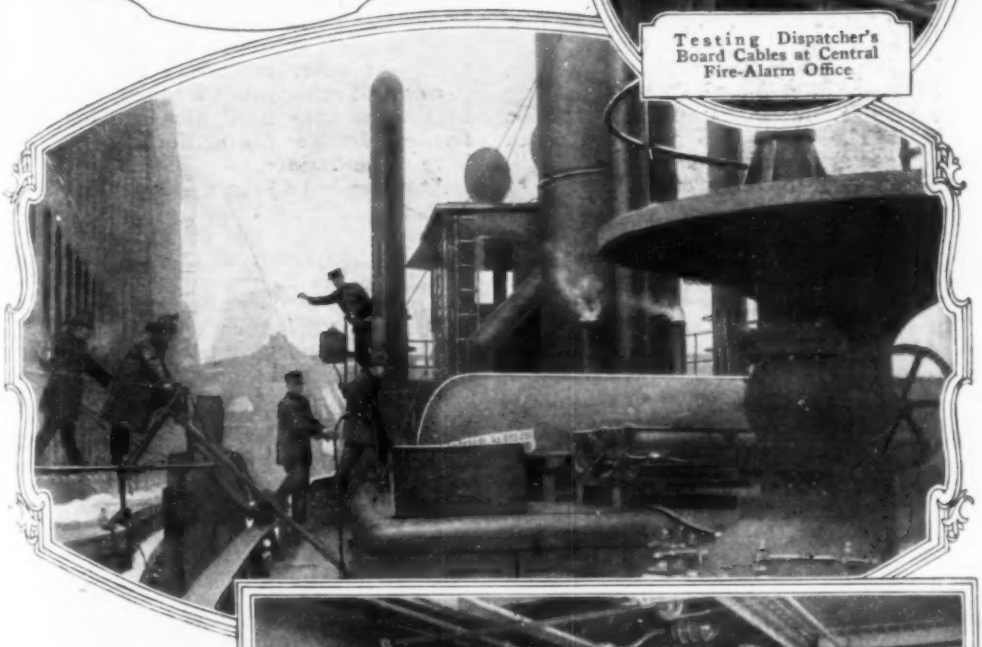
pilot needs no further word. Those numbers give him the location of the fire, a mental picture of every twist of the river or curve in the harbor he will have to make, and as he directs the four pipemen in casting off the lines, he has calculated just how long it will take him to reach the fire. The stokers rake their fires forward and in a few seconds the steam gauges, already trembling at 140 pounds, are mounting toward 170.

As soon as the crew hit the deck, the engineer and oiler took their positions to open the valves releasing the steam to the turbines. At the pilot's signal, given the instant the lines are off, they twirl the handles; the room vibrates to the whir of the motors and the propellers begin to kick up a froth astern. The whole action from quarters to moving ship has taken not more than forty-five seconds. Now it's up to the pilot to get the boat to the fire. Throwing the right-hand control back and the left one forward and with a turn of the tiller, he sends the boat toward mid-stream. As it swings into the current, he reaches for the siren cord above his head. Two pulls notify the bridge tender to the north that the boat is headed in that direction. It would have been three for south. It's three shrieks of the siren for every bridge after that, the accepted code for street viaducts, four for railroad bridges, until the fire is reached. Yelling like a demon, the red fire fighter puts its nose into the spray and plunges forward. The whistle, often compared to the howl of a hyena, serves to warn other craft, rouse bridge tenders and spread the news that there is a fire in the neighborhood. Returning, the boat toots a soft musical sound, a reassuring note that soothes the nerves of distracted bridge men and spreads the good word that the fire is out. At night, the whistle is supplemented by a 1,700-candlepower searchlight to help direct the boat.

With lines cast off and the ship under way, the crew don their helmets and coats, which are kept in a forward hatch. The hose-house doors are opened, and the valves and connections at the standpipes steamed out, if it is cold weather, to make sure they are not frozen. Holders for the nozzles that fit in holes along the edge of the rail are put within reach. As soon as the boat starts, the pumps begin to turn and they run dry to the fire. When the scene is reached, the engineer or oiler

Reading a Box-Alarm Number from Ticker Tape at Engine-Company Quarters

Testing Dispatcher's Board Cables at Central Fire-Alarm Office



Boarding Fireboat for a Run and Getting Hose Lines from Forward Storeroom; Pilot Is on the Bridge Ordering the Hawsers Cast Off; Steam Is Up, and by the Time the Crew Has Reached the Deck, the Boat Will Be under Way

opens the intake valve by raising a lever and water rushes through the 450 square inches of opening, a series of three-eighths inch holes cut through the steel side of the boat.

At the fire, the captain scrambles ashore and reports personally to the chief in command. "Company 37, chief," he shouts above the chugging of fleeter engines already at the spot. Perhaps it looks like a serious fire. "Lead away four lines," may be the chief's reply. That means business for the fireboat. If not wanted, "stand by" or "go home" would have been the orders. Hose is connected and pulled to the place where it is wanted by a cart from a street company that regularly accompanies the fireboat for this particular purpose. "Play away," is probably the next order from the chief. That means water. Pipemen, already at their posts, turn the big valve wheels and streams that have been throbbing at the shut-off plates leap along and stiffen the lines, quickening the nozzles into hissing mouths that pour their broadside into the flames. The standpipes are used when the flames are within close range.

Down in the boiler rooms, the stokers are heaving coal, engineer and oiler are watching pumps and turbines, pipemen possibly aided by men from the street companies are either on deck or on shore handling the lines under the direction of their own captain and the chief, and the pilot has assumed temporary command of the deck, directing the men at the gates or ordering the spuds lowered if the boat begins to drift. The hazard of falling walls follows the fireboat too and the pilot is the man responsible for his craft in such an emergency.

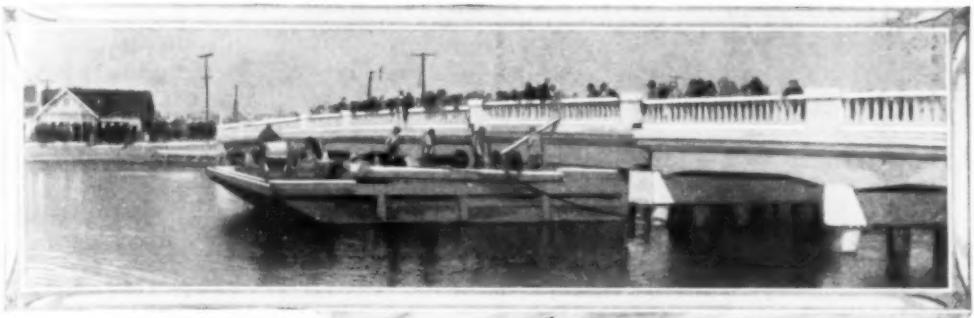
Back from the fire, the company notifies the central office that the fire is out, and the task of cleaning up the boat, putting the hose lines away and getting ready for the next call is in order. Like men in other companies, the crew of the fireboat plays a waiting game, but there is a daily round of tasks that must be done, such as polishing the brass, emptying the boat's ashes, work in which all hands join; and, then, of course, quarters must be kept shipshape and scrupulously clean.

Rivers and harbors of our cities are little worlds of their own, and here the fireboats find all sorts of jobs to do, many of them escaping notice in the regular reports of the vessels' logs. When fishermen get marooned in the ice, the fireboat is often called to attack drifts too thick for other craft and rescue them. Scows and other boats frequently call for help when they need pumping out, and flooded bridge foundations sometimes have to be drained.

At the end of a year, a fireboat may have answered only 200 calls, traveled less than 500 miles and actually pumped water less than 100 hours, but no one measures the value of a fire company on a time basis, and property owners and fire chiefs unite in declaring that when a big blaze breaks out on the water front, one of the most welcome sounds is the screech of a demon fireboat coming to the rescue.

Fast Motors Have Almost Displaced the Horse for Fire Service, but in Some Cities, Gallant Steeds Still Thunder Eagerly Forward at the Call of Duty

TIDE LIFTS CONCRETE BRIDGE SPAN ON BOAT



Barge in Position under Span, and Bridge Section Removed, Resting on the Boat and Swung Clear to Permit the Dredge to Pass Through

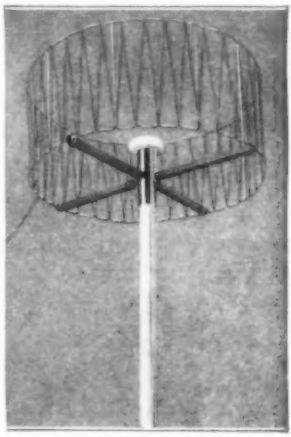
When the California highway commission built a concrete bridge across Alamitos bay, near Long Beach, the center span, forty-six and one-half feet long, was constructed so that it could be removed easily to permit a dredger to pass through when work was started on the city's recreation park. The foresight of the engineers was rewarded recently when a call came for the dredge. The span was swung aside and placed back with only a few hours' delay to traffic and at a cost of only $500. A barge was run under the loose section at low tide and as the water rose in the channel, it boosted the concrete block above its supports on the bridge until it rested wholly on the deck of the barge. The current then swung the craft and its load aside, leaving the passage clear for the dredge. A tug hauled the barge back to the bridge as soon as the tide began to recede, and three hours after the span had been raised, the section settled into its original position.

Burlap Spreader for Cement Roads Prevents Damage to Surface

For covering new concrete roads during the curing and drying period, a reel on wheels that follows the form marks and unwinds a wide "blanket" of burlap or other material, has been introduced. It is constructed of lattice-steel framework, consists of only seven parts, which can be knocked down for convenience in shipping, and is operated by means of sprocket-and-chain drive with a crank. In order that no scratches may be caused in the finished surface by the covering, it is laid, not dragged, over the road.

Circular Aerial Is Non-Directional and Works Inside or Outdoors

A new type of antenna, which, owing to its circular shape, is claimed to be non-directional and to result in equally good reception from all points of the compass, has appeared in England. It is designed for either indoor or outdoor use. It consists of two rings supported on an upright by means of two crossarms. Special braided copper-wire tape is wound from one ring to the other in such a manner that practically the entire surface is exposed to the incoming radio waves. It is claimed this type of aerial will increase the range of many receivers.



Radio Microphone Equipped with Signaling Device to Notify Performers When to Begin Broadcasting

Radio Microphone Signals Artists to Get Ready to Broadcast

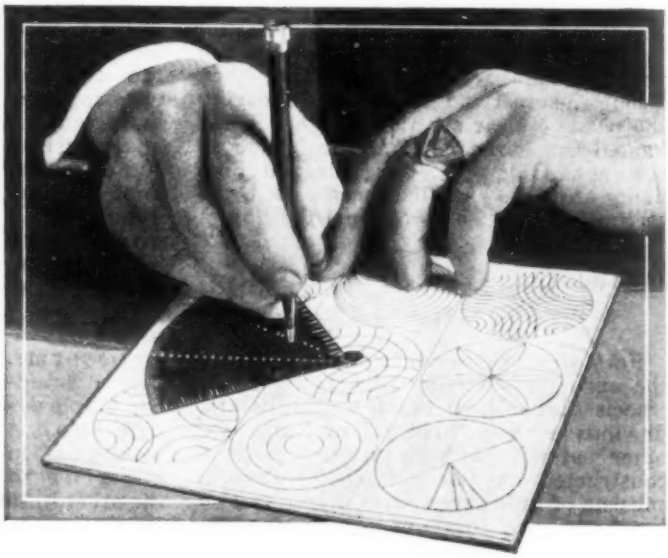
Eliminating much of the time lost in radio-broadcasting stations while waiting for the different artists to "go on the air," a signaling attachment on a microphone notifies a performer when to prepare for or begin broadcasting. Where several studios are hooked up with a transmitter, the instrument can be used to give an artist in one of the rooms the cue to get ready while the preceding number is being broadcast. Equipped with the device, a station may so shorten its waiting time that desired features can be added to the ordinary programs. It also does away with the necessity of telephoning such instruction where installed for acts broadcasting from outside points and puts the director in instant touch with performers at a distance.

Thirty Thousand English Patents

Applications for patents in Great Britain totaled more than 30,000 last year, according to reports, and although the number is 1,000 less than was received in 1923, there was an increase during the later months. Radio developments were the most numerous subjects of the patents, more than 800 being granted, an increase of 200 over the year before. Many applications from inventors in this field were not pressed, the originators apparently realizing that their ideas were in many cases commercially useless or had become out of date while the matter was pending because of the rapid progress in this science. Many patents were for household improvements and the inventions were made by women.

Drawing Tool for Fancy Designs Has Eleven Different Uses

Outlines for a wide variety of fancy patterns can be quickly and accurately made with a simple drawing instrument that combines eleven tools in one. It is a flat sheet of aluminum cut in triangle shape with a rounded base. At the top is a small tab, perforated to hold a thumbtack as the pivot. There are rows of other holes for the pencil point and by swinging the plate around, circles and curves of many combinations can be drawn. The straight sides are ruled in eighths and sixteenths of an inch and the base is numbered in degrees of an angle. The tool may be used as a compass, divider, protractor, rule, square, bevel, gauge, miter, plumb, level or angle finder, takes up but little space in the artist's kit and is easily adjusted for its various uses.



Instrument in Use and Samples of Drawings Quickly Made with It; Thumbtack in Center Is the Pivot

Weighing the World

IN a curious, cell-like compartment of concrete thirty-five feet below the earth's surface, Dr. Paul R. Heyl of the bureau of standards is weighing the whole world in a most remarkable manner.

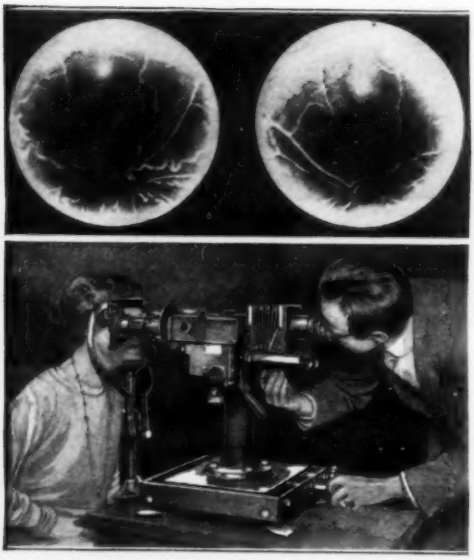
When you think of weighing the world, you visualize immediately mammoth platform scales, the like of which you never thought could be made. In fancy's eye, you picture our great globe balanced delicately upon these scales while an expert scientist manipulates the weights in order to make the scale bar balance.

No, the scientific task of weighing the world is not consummated in that fashion. Dr. Heyl's laboratory is located far underground in order that the delicate apparatus with which he works may be free from the effects of vibrations such as set up by moving motor trucks, speeding automobiles and ponderous street cars. He does not isolate himself because he desires secrecy, but because he wishes to insure the scientific data he seeks against possible errors introduced by untoward commotions on the earth's face.

This great globe on which we live weighs six thousand million million million tons, if we are to accept the figures of other scientists, who attempted to weigh it some three decades ago. The figure obtained by these experts was carried to an accuracy of one part in 5,000. Dr. Heyl is working for greater accuracy—one part in 60,000. This is how he is turning the trick.

A so-called torsion pendulum, which terminates in two small gold balls, is suspended in a brass bell jar in a concreted space just outside the subterranean laboratory. This bell jar widens from an upper diameter of five inches to a base diameter of one foot. The little balls of gold are suspended by tungsten filaments, one one-thousandth of an inch in diameter. The arrangement is such that by the action of gravitation, the pendulum is set into oscillation during one of the test periods. A reflecting mirror carries the motions of the turning pendulum to the laboratory where they are noted by Dr. Heyl. He uses these data in a scientific formula, along with figures representing the distances between the balls and a steel cylinder within the bell jar, and between the balls and the center of the earth, to figure out how many times heavier the earth is than the cylinder. In this way, he calculates the accurate weight of the earth. When the weight of the world is determined, it will be easily possible then to ascertain the weight of the United States, Africa or Siam. Lines drawn from the borders of the United States or any other country would be extended to the center of the earth to form a cone or other geometrical figure of a size that could be calculated.

Besides the precautions taken to protect the delicate apparatus against vibrations, the concrete vault containing it is kept at a constant temperature and the air is evacuated from the bell jar to reduce resistance to the motion of the pendulum.



Taking Pictures of Patient's Eyes with Optical Camera; Above, Finished Photos of Eyeball

Eye Ills Revealed by Photographs Taken with Optical Camera

Diseases of the human eye can be detected in pictures made with a camera which photographs the inside of the organ. Ills that might require extended examinations to locate by ordinary methods, are said to be quickly disclosed by the lenses which faithfully reproduce the inner surface of the eyeball. With the aid of the pictures, diseases and their effects may be easily studied and remedied. To illuminate the interior of the eye while the plate is being exposed, a powerful electric-light tube with reflector is attached to the instrument.

How Broadway Got Its Name

The brilliant gleam of thousands of electric signs that nightly tell their stories to passers-by is the answer to the query as to how Broadway, New York, has become known the world over as "The Great White Way." It is estimated that there are 1,095,841 incandescent lamps along this sparkling street, and that more than 2,000 men are kept busy changing and repairing the displays. From the first moving sign, depicting a chariot race, the clusters of illumination have grown until they now include kittens that wind balls of twine, women with umbrellas walking in electrical rain, clowns that juggle and scores of other displays.

Kitchen for Campers Folded in Box for Auto Running Board

Everything necessary for the preparation of a cooked meal is provided for campers and tourists by a portable kitchen which can be carried on the running board or trunk rack of an automobile. The apparatus includes a stove and oven for baking and a refrigerator for the preservation of perishable foods. The cabinet which contains the utensils need not be dismounted from the car when required, but removable legs are furnished for use if the outfit is to be set up for a long period. It is of metal throughout and proof against fire, weather and dust. As the kitchen occupies little space when packed, it is suitable for installation on a yacht, in a tent or as an accessory for light housekeeping. Compartments are arranged for dishes and cutlery, and the cooler is well insulated from contact with the stove.

Everything Needed for a "Home-Cooked" Meal Is Provided by This Portable Campers' Kitchen Carried on the Auto Running Board

LIFE PRESERVER PERMITS SITTING IN WATER

To the ordinary inflated type of circular life preserver, rubber trousers, slippers and paddles for the legs and a pair of oars have been added to relieve discomfort and give the wearer better opportunity to reach safety. The outfit is so large and the trousers so adjusted that a sitting posture can be assumed.

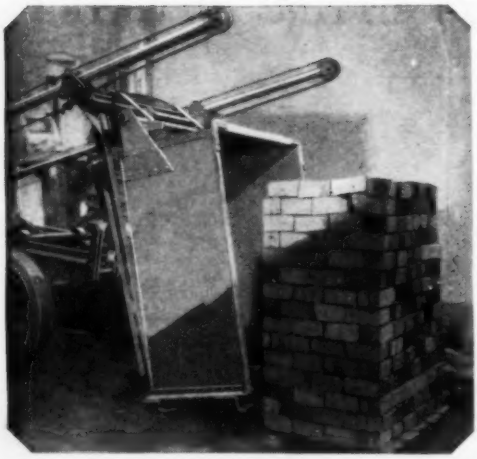
Paddling While Sitting Comfortably in the Water; Right, the Entire Suit, Trousers with Fins and Big Inflated Tire Belt

Careful Herding of Alaskan Seals Increases Trade in Skins

Alaskan seal herds now number about 700,000, an increase of 50,000 over last year according to the reports of the commissioner of fisheries. Nearly 16,000 skins were taken in one year from St. Paul and St. George islands in the Bering sea where ninety per cent of all the fur seals in the world are said to gather during the breeding season. Natives there, supervised by fifteen trained white employes, protect the seal herds, take the skins and also care for the blue foxes that inhabit the islands. While the seals are disporting themselves in the surf, vessels of the coast-guard service are stationed near by to watch over them, and the ships follow them when they get ready to migrate. Strict provisions are made to keep the seals from dying out. Not less that 5,000 three-year-old males must be reserved each season. These, set aside for breeding purposes, are sometimes branded by shearing patches of fur from their heads.

Loud Speaker, Three by Five Inches, Gives Volume and Clear Tone

One of the smallest loud speakers on the market is a combination box-and-horn affair, three inches wide and five inches high, which is said to be capable of giving considerable volume and pure tones. The horn is manufactured of a highly polished material that resembles tortoise shell



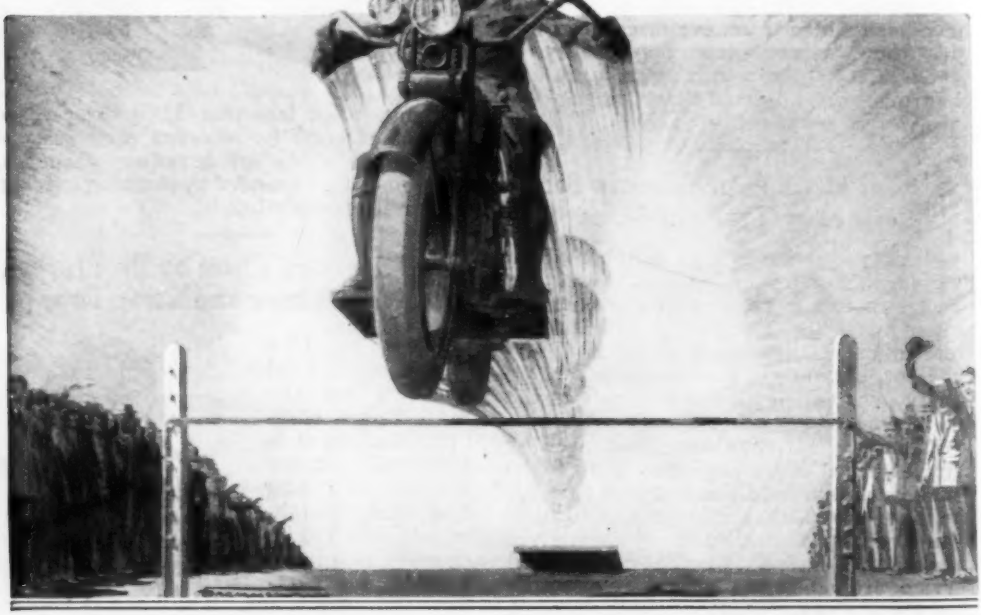
As Truck Body Is Tipped Up and Moved Away, Bricks Remain in Neat Pile

Truck Dumps Brick in Neat Pile Saving Time and Breakage

Auto trucks with a demountable type of body that dumps 500 brick in an orderly stack instead of in a loose heap have been placed on the market for use on construction jobs and in brick yards. In unloading, the body is rolled to the back of the truck, tipped by a two-masted derrick and lowered gently to the ground, leaving space enough for the brick to pass through the rear, which is left open, without binding the sides of the body. The truck can be moved slowly away, leaving the brick in a neat pile. Furthermore, since the body is so connected to the derrick that it may be detached from it with little trouble, one may be left at the yard for loading while the other is hauled away. The filled body is pulled onto the truck by simply reversing the derrick, which is controlled by the driver from his seat and operated by the truck motor.

Motorcycle Broad-Jump Contest Adds Thrill to Police Games

Broad jumping with motorcycles proved one of the most exciting events at a policemen's annual racing meet in a southern city, the contest affording spectators unusual demonstrations in riding skill and the sturdiness of the machines. Roaring down a straightaway, the motorcycles were guided into an inclined take-off board, the slight upgrade being sufficient to send them hurtling through the air for long leaps. The winner's mark of thirty-four feet climaxed the event. The test of the rider's skill came at the end of the jump, keeping his machine from skidding or falling in the soft soil being most difficult.



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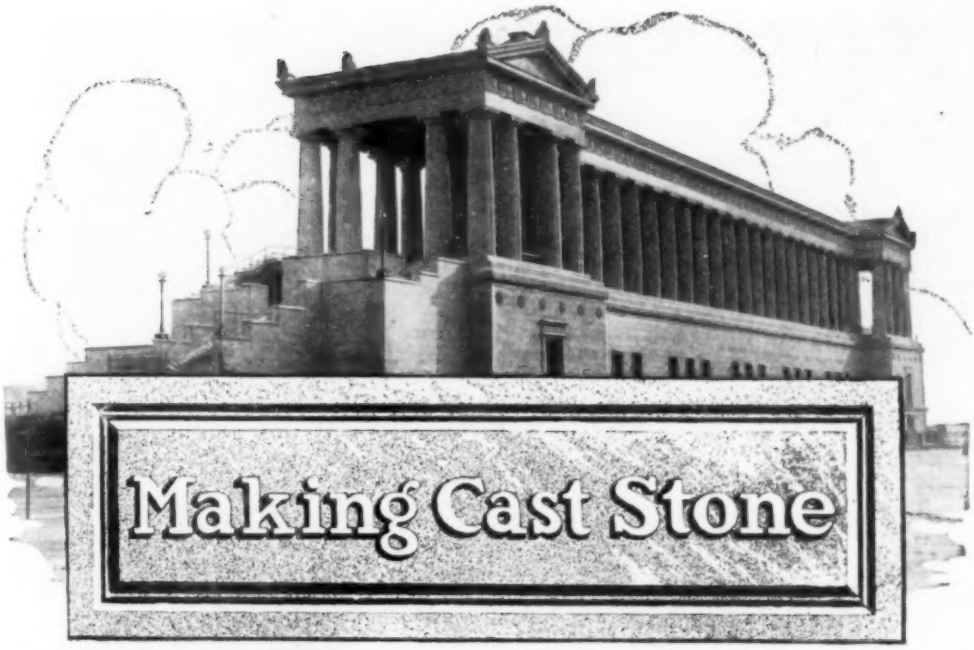
Roaring Up to the Take-Off, the Motorcycles Leaped Like Trained Athletes, Skimming over a Low Hurdle and Landing Thirty Feet and More Away While Crowds Cheered



Making Cast Stone

New Building Material Outrivals Original Material in Beauty of Coloring While Cost Is Considerably Less

GRINDING up huge blocks of beautiful white marble into fine gravel, running the material through a concrete mixer and casting building stone as hard as the original block yet more beautiful in coloring, and at the same time cheaper, is America's most modern contribution to the building art. Starting out as a concrete process, the cast-stone business finishes its material like any stone-cutting plant. In fact, one of the large cast-stone plants in New York employs more skilled marble cutters to do the delicate hand tooling than any single natural-stone quarry in the country. The finished product cannot be told from natural stone, except for its more delicate gradations of color and their wider range. The variations in color are possible through the introduction of various kinds of marble and mineral pigments in the concrete mixture. The process, however, bears no relation to any of the concrete-block systems heretofore in use—in fact, it is more elaborate and requires far more equipment than the finest marble quarry and cutting plant. The quarried marble must be ground into the fine aggregate, mixed by special equipment, cast in specially prepared molds, either of sand, plaster or glue, the molds being made either from wooden patterns or from clay models prepared by artists; and then the casting, after curing for a

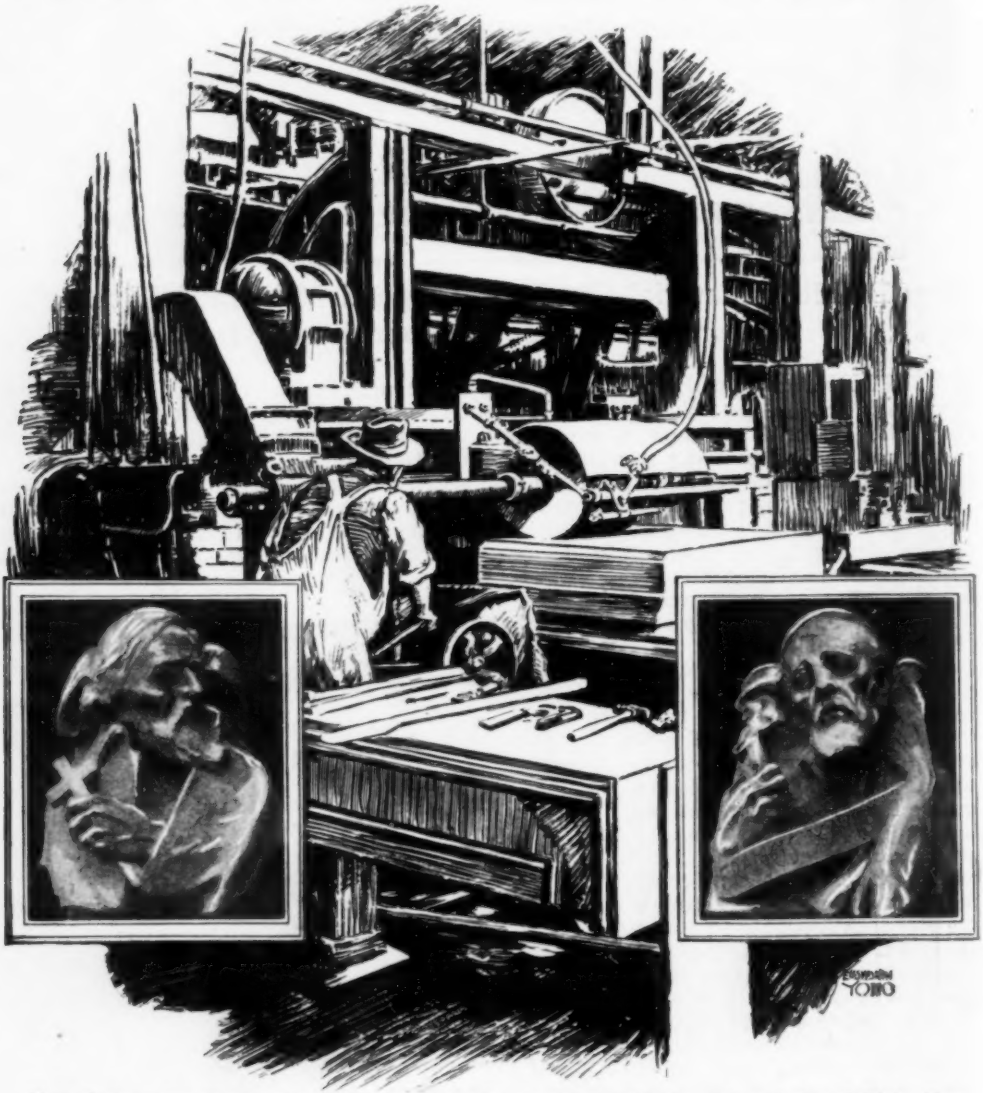
Sculptors Model Decorative Bits in Clay or Plaster as Patterns for the Molds

long time, is carved, planed, machined and cut like any piece of natural stone.

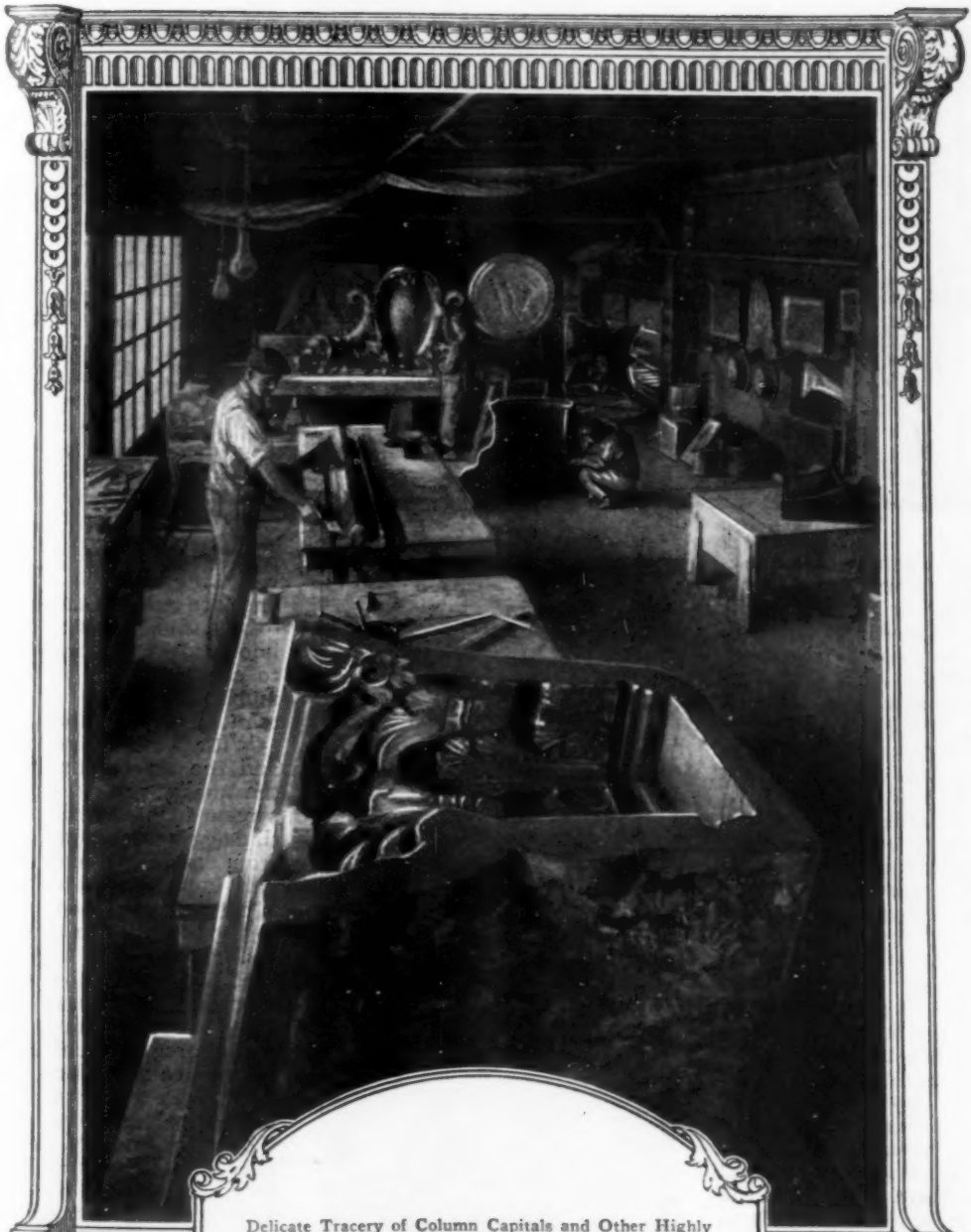
Despite the intricate process used, the cast marble is only twenty per cent more expensive than soft building limestone, and about as much cheaper than either granite or natural marble.

In natural-marble quarrying, it is not unusual to split out a 4,000-pound block to produce an 850-pound finished piece of building stone. The two-ton block is rough-finished at the quarry to about 1,500 pounds, wasting 2,500 pounds of fine marble, and is then shipped for final cutting and tooling on the job, paying freight on the excess 650 pounds, which eventually will be cut off and wasted. The cast-stone plant not only saves the freight, but actually operates on the waste of the marble quarry.

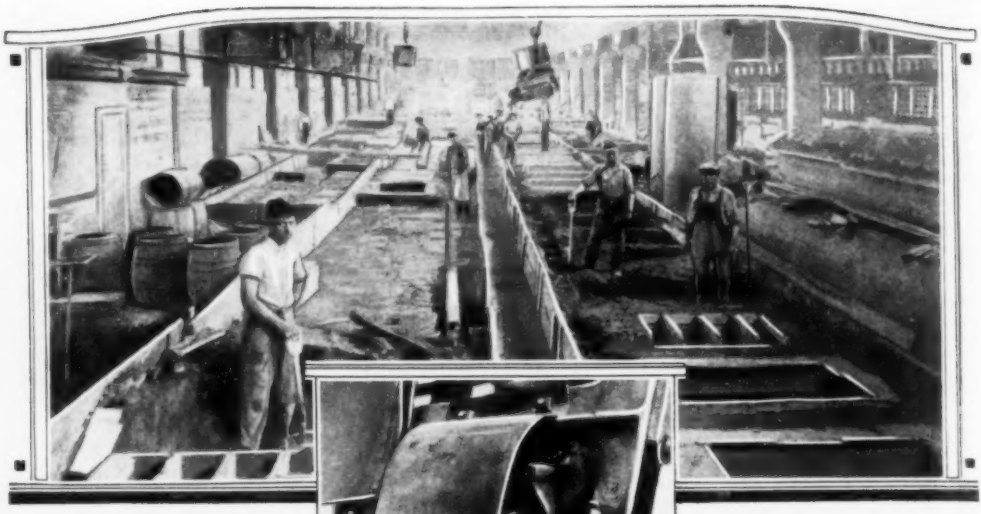
Making cast stone starts in the pattern and mold rooms, where the architect's drawings are reduced either to wooden patterns or to clay and plaster molds. With the patterns completed, the architect selects the desired color, texture and surface treatment from samples prepared from exact mixing formulas. It is possible to get any combination of color, material and treatment desired. With natural



Giant Carborundum Planers Put the Finishing Touches on the Cast Blocks, and, at Left and Right, Two Figures Cast in Marble for a Public Building

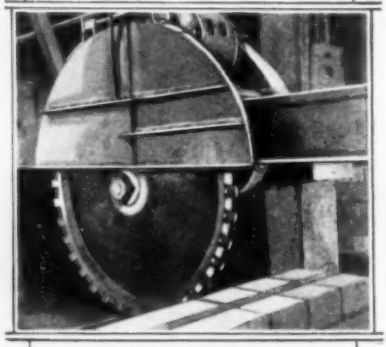


Delicate Tracery of Column Capitals and Other Highly Carved Pieces Are Reproduced from the Sculptor's Clay Models in Plaster of Paris and Glue, Making Due Allowance for Shrinkage in Casting and Likewise Allowing Enough Extra Material for the Final Hand Carving; the Casting System, However, Reduces Hand Work to the Minimum and Turns Out the Most Ornate Carving in a Fraction of the Time Required under the Old System, Besides Saving a Vast Amount of Material



Casting Floor with Mold Beds, and a Carborundum Planer for Grooved Surfaces

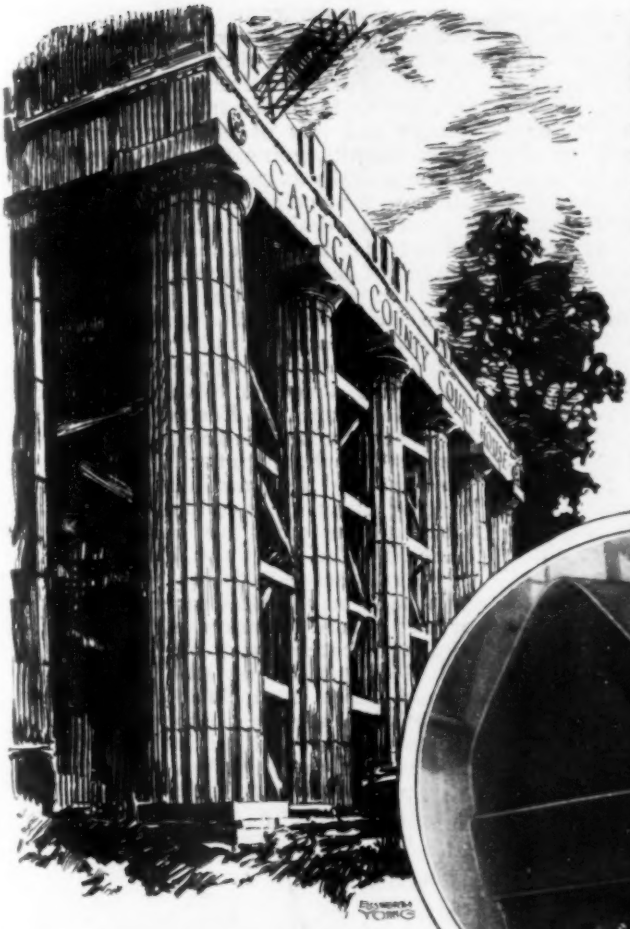
Air-Driven Chisels Are Used for Much of the Final Carving and Rough Finishing



Giant Saws with Carborundum Teeth Slice Long Castings into Building Stone

stone a soft rock looks soft when finished because it is necessarily machined and cut with a soft-rock treatment, while a hard rock likewise shows its hardness by its finish and more delicate and sharply defined lines. With cast stone the architect, if he wishes, can have a marble building of granite finish with soft-rock carving. Because of the opportunities offered by the casting procedure, several innovations new to stonework are introduced. If the architect desires a delicate and graceful lintel, and yet wants it to carry a heavy load, steel reinforcing rods are introduced. If anchor bolts are desired to more firmly hold the finished piece in place, they too are placed in the mold. The heavy steel loops, called setting hooks, are carefully added. They are so placed with relation to the center of gravity of the finished piece that, when the crane picks them up and swings the stone up the side of the building, it will hang right side up and face out, just as it is to be placed. The setting hooks make it possible to erect the cast stone much more rapidly than natural material.

With the molds ready and the marble from the quarry ground and screened into various-size aggregates ranging from one-fourth to one-half inch, the material is carefully weighed into the big two-ton mixers. Even the water used is measured so that every batch receives exactly the same amount. The aggregate is mixed to produce the color desired, with gray and white marbles from the Gouverneur, N. Y., quarry; buff travertine from Colorado; white marble from Georgia; green serpentine, black copper slag, and any of a number of colored granites. If more color is necessary, manganese oxide, buff iron oxide, red iron oxide or ultramarine or Prussian blue may be used. The secret of the cast stone's hardness lies in the



Erecting the Portico of the Beautiful Cayuga County Courthouse at Auburn, New York, and, Right, Pouring Cast Stone into Sand Molds from the Traveling Mixer Which Keeps Contents Agitated

mixing. Instead of the one to five minutes which ordinary concrete gets in the mixer, the marble material is mixed for fifteen minutes, and then drawn off into the distributing ladle, on a traveling crane. Inside the distributor is another mixer, with churnlike paddle wheels, which keeps the material agitated for another ten minutes. Cement mixtures have a definite period of expansion and contraction, and the long period of mixing is designed to carry the material over this period, while keeping it plastic enough to pour easily. When it is finally poured contraction has already reached the limit and the material sets promptly.

The water used to maintain the plastic character for twenty-five minutes is considerably in excess of that used in ordinary concrete practice, but the sand mold promptly draws the surplus out of the cement, and then retains it in itself, so that the damp sand retards and regulates the curing process. As the sand draws the water from the mixture a suction is set up which produces a sort of toughness, or casehardening of the surface of the cast-

ing. The weight of the stone when cured usually exceeds 150 pounds per cubic foot and its tensile strength will range from 7,000 to 10,000 pounds per square inch, as compared to around 1,000 pounds per square inch for ordinary structural concrete. The hardened surface gives the cast material ability not only to resist absorption of water but likewise other materials. A New York building was erected of cast stone after the architect had emptied a bottle of ink on a sample submitted, and then, after the ink dried, scraped it all away with a penknife, leaving the stone unstained.

After the castings have hardened for several days in the sand molds they are lifted out by a crane and removed to a curing room, where even temperature and humidity are maintained the year around. Here the blocks and columns present a rough appearance, with considerable sand clinging to the surfaces. All patterns are made slightly oversize, however, to allow for the final cutting and finishing.

When curing has progressed far enough the castings go to the planers, if they are flat. Broad wheels of carborundum, revolving at high speed, plane down the surfaces. The carborundum is surfaced with diamond tools to fit templates made from the architect's drawings, if special finishes or curved lines are desired. Huge circular saws, with teeth of carborundum, cut the blocks and bits of exterior trim to the right lengths, going through a section of stone as easily as the grocer passes a knife through a piece of cheese.

Specially designed machines take care of the planing of odd surfaces, such as fluted and tapered columns. Column making is in itself a special art. The Greeks found long ago that a graceful, tapered and fluted column, had to have a slight bulge in the center to look straight to the eye, while a column with straight sides would look concave. Each section of a cast-stone column is made from a special wood pattern, which, by intricate calculations, has just the right amount of taper and bulging curve to give the proper effect when all the parts are finished and assembled. The final finish, if it is to be one of the roughened variations, is done either with hand-manipulated pneumatic chisels, or with special hammers and tools. Most of the delicate carving on lacy grills for tall Gothic windows, and similar ornamental pieces, is blocked out with pneumatic chisels and then finished by sculptor artists with hand chisel and mallet. The final step is the shipping. The stone is packed in wood shavings, a layer of ten inches to a foot surrounding each piece, according to size.

Inset Hooks Make It Easy to Handle This Huge Column Section, While Chiseled Holes Receive Hook Heads of Next Piece

Birds Seek Old Home Year after Year

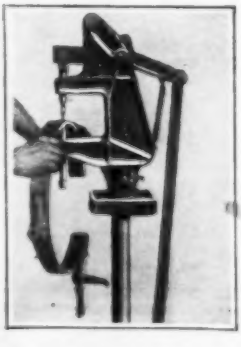
Numerous migratory birds return to the same places every summer and are often found living in their old nests, according to Prof. Frank Smith of the University of Illinois, who stated that thousands of the songsters have been captured and banded for future identification. Although many species travel hundreds and thousands of miles in their annual migrations, recaptured birds wearing the leg markers show that large numbers repeatedly find their way back to the homes of previous years. The scientist said it has been learned that some even take up with the same mates. Identification bands taken from dead birds picked up at points far away from where they were tagged indicated the great distances they cover in annual flights and the paths they follow. Among the best-known varieties making regular returns to summer homes are the house wrens. Most records concerning water fowl were gathered from dead birds.

Mute Actors That Serve Both Play and Players Well, the Jungle of Stage Ropes for Lifting Drops and Curtains

Miles of Rope Back of Stage Serve as Hidden Actors

Back of the glow of the footlights where few of the audience ever see them, are thousands of feet of ropes used to shift the scenes of stage productions. Big theaters often have several miles of this material, hung in what appears to the layman to be a hopeless confusion of dangling ends and loops, but every piece is exactly adjusted and performs its work silently and swiftly. Steel cable has been found unsuited to this task because of its stiffness. The favorite size is one-inch hemp rope. It is strong enough to support the weights and curtains and sufficiently supple to work without becoming tangled.

Auto Brake Bands Riveted Tight to Insure Long Life



Designed to eliminate imperfect brake-band lining, a new foot-power machine insures an absolutely tight rivet, without which the entire band is a failure. The action of the machine, with its toggle arrangement, is light at the start, increasing gradually as the foot pressure is applied. The smallest bands can be riveted either from the top or bottom side.

¶Popular Mechanics Magazine does not publish the name of maker or seller of any device described in its pages, but this information is kept on file and will be furnished free by addressing our Bureau of Information.

Signal Man on Observer's Tower Firing Light Warning to Passing Airship from Special Pistol

Pistol That Shoots Bullets of Light Directs Airplane Express

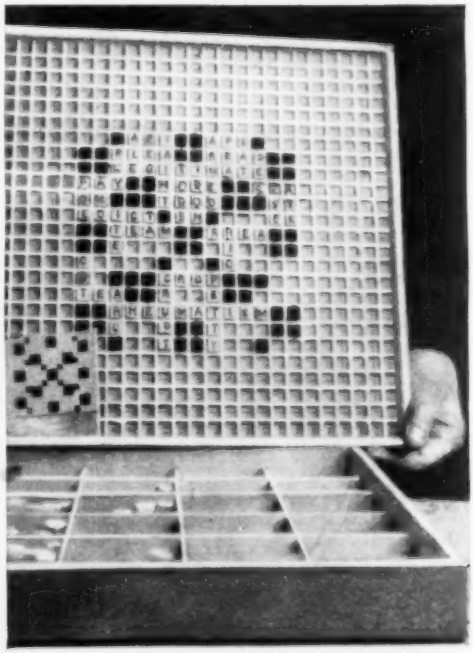
Reaching high above buildings near London, is an air-traffic control tower from which wireless operators can communicate with airplane express "trains" flying between England and the continent, and guide them to the airdrome which he can see from his lofty perch in spite of fogs and mists. At night and on dark days, signals are sometimes given with a pistol that shoots brilliant light bombs visible at considerable distances. Standing on one of the balconies of the tower, the controller fires the lights for the assurance or warning of the pilots.

Hats Shaped with Electric Sandbag That Replaces Blocker's Iron

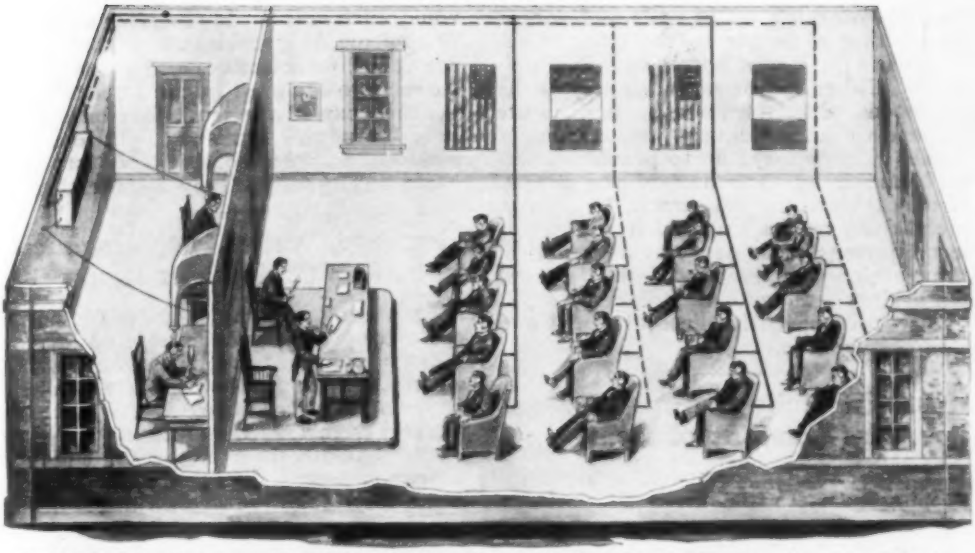
The old-time hatter's block and iron by which headgear was shaped, has been replaced by an electrically heated sandbag that does the work in a fraction of the time consumed by the hand process. Placed over a mold, the felt crown is made to conform evenly to the block by the weight of the hot sand as the heavy bag is permitted to settle over the material. Previous to this operation, the fabric is subjected to a series of processes controlled by electricity, in which the felt is assembled from mixtures of fur, silk and wool by blowers and suction machines. The cut pieces are ironed at high temperatures and partly shaped before the blocking treatment is applied. The smooth finish of the felt hats and high polish of the silk varieties are then produced by electric clippers and buffing wheels.

Puzzle Frame with Loose Letters Relieves Cross-Word Worries

For both making and solving cross-word puzzles, a slotted frame with loose letters, that can be inserted or taken out like type, has been placed on the market. It has twenty-five square spaces in vertical and horizontal lines, giving ample room for devising a wide variety of patterns. Black spaces are represented by dark-colored cubes. The letters protrude above the edges of the compartments so that they can be grasped easily and are kept in a divided tray that accompanies the outfit. Original designs can be made with this board or printed copies followed easily. The set saves the bother of frequent erasures and is also helpful to children in solving simpler puzzles, giving them the sport of playing with blocks as well as working cross words. Divisions in the board are located quickly by four rows of numbers, on the sides and through the center.



Tray with Letters and Black Squares Inserted, and Compartment Holder for the Blocks



English Is Being Spoken over Dotted Line and Spanish over the Dark One, the Earphone Users Receiving the Words from Translators in Room Back of Speaker

Several Languages Spoken at Once through Radio Relay System

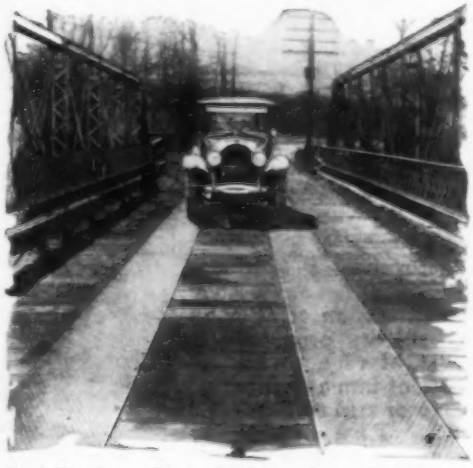
With the help of an ingenious radio relay system, delegates at an international automobile meeting, although they spoke different languages, were able to enjoy the same speeches and transact their business with little trouble. This was accomplished by means of sets of earphones distributed to the seats and connected to microphones at which were seated interpreters who translated the speeches into the different languages as they were given in an adjoining room. Sounds passed to them through openings in the wall and into horns with dictaphone extensions. Amplifying apparatus assured sufficient volume to the different ear sets. The success of the plan was heralded as further indication of the possibilities of radio for promoting international good will.

Propellers to Drive Passenger Cars on Overhead Monorail System

A propeller-driven, overhead monorail transportation system is being planned in Paris to help solve the traffic problem. The cars will be supported from a single rail. If experiments on the first line, which is to be built without curves to save expense, prove successful, a speed of fifty miles an hour will be attempted. Power will be furnished either by electricity taken from the rail or by an internal-combustion engine within the car. The towers for the track will be 100 feet high and 500 feet apart, giving a clearance of fifty-five feet for the carriages above the ground. If the tests are satisfactory, it is proposed to erect eight of these lines from near the center of the city to serve the suburbs.

Traffic Treads Save Wood Bridges and Protect Vehicle Tires

Steel treads, laid along the wheel lines on floors of wooden bridges, guard the timbers from wear and tear of traffic and, it is said, reduce vibration which tends to weaken the structures. The strips also



Steel Treads on Floor of Wooden Bridge Which Protect Both Timbers and Vehicle Tires

stop the working up of nails and spikes, eliminating a danger to the tires of vehicles and the feet of horses and other animals. Either old or new bridges can be equipped with the treads, which are claimed to make frequent replacement of planks unnecessary and to prevent "chatter" caused by loosening of the beams. Grooves worn in the wood by heavy, metal-tired trucks and which might collect injurious pools of water are avoided, thus prolonging the life of the timbers. On bridges that can carry two-way traffic, one strip is placed in the center and one along either side.

House-Car Built of Airplane Wood Has Comforts of Home

With a kitchen compartment, roomy sleeping quarters and fitted with wicker furniture, an auto bungalow provided most of the comforts of home during a motor trip to Florida. The outside was constructed of light-weight plywood, such as is used in building airplanes. A linoleum floor, cabinet with ample storage space, work shelves and a portable oil stove were included in the kitchen space which occupied the front part of the car. Broad windows furnished light and ventilation and were so arranged that they could be closed tightly in bad weather.

Kitchen of the Touring Car with Shelves and Cabinets Built about the Steering Wheel, and Exterior View Showing Entire Bungalow and Its Owners Enjoying a Rest between Runs

Rat and Weasel Help Engineers Run Cable under River

Engineers running a line of power cables from the Canadian side of Niagara falls to Buffalo, were halted temporarily when they found that the steel towers used to carry the wires over the stream already were loaded to capacity. While searching along the shore, workmen found a four-inch gas main extending to the American side of the river, which is nearly half a mile wide and seventy-five feet deep at this point. A large sewer rat was captured, a stout string tied about its body, and it was started through the pipe. Halfway across, it stopped and refused to go farther—another delay and another problem. Finally, one of the engineers conceived the idea of sending a weasel in pursuit of the rat. The scheme worked. Not many seconds later, the rat popped out on the American side, the string in tow and the weasel close behind. Heavier cord was pulled into the conduit and then the power cables were dragged through.

Armless Write with Pencil on Belt — Motor-Driven Steel Canal Barge

Manned by a Crew Unskilled in Seamanship, This Oarless Lifeboat Which Gets Its Power from a Lever-Operated Propeller, Can Make Speed in Almost Any Seas

Oars Are Replaced by Hand Levers in Driving Lifeboat

A hand-power lifeboat with a series of levers that turn a propeller, thus eliminating the need for skilled seamen in its operation, has been built in England. The craft can be put under way instantly and like the ordinary types of such boats can traverse almost any kind of rough seas. The absence of oars which may be lost or damaged by heavy waves, eliminates the risk of crippling the boat's power in emergencies. In use, it is believed the craft will reduce the dangers of the sea, since shipwreck victims, unskilled in rowing or handling of engines, may work their way to safety in the lever-propelled boat.

Lights under Car Give Clear View of Auto in All Directions

As a prevention against confusion often caused by glaring lights of automobiles in night traffic, a system of floodlights directed on the ground beneath a car has been devised with the use of magnifying glasses. The soft glow makes the vehicle stand out in clear view from all directions. At the rear and on one side the rays are red, those on the other side are green, and the front and downward beams are white. The device which is the source of the light can burn electric current, acetylene or other fuel. The various glows are caused by a series of colored lenses which may be

Safety Floodlights underneath Auto Which Cause Car to Show Up Distinctly at Night

arranged to meet any rules of traffic covering signal lighting.

Armless Write with Pencil on Belt Strapped about the Chest

Writing and painting are made possible for armless persons by a beltlike device

Pencil and Brush Holder Which May Be Used by Armless Persons for Writing or Painting

to which is attached a holder for pencils or brushes. Fastened around the chest, the apparatus can be easily directed by slight movements of the body. The instrument can also be used to turn the pages of a book or hold sketching materials for drawing. It is claimed a person deprived of the use of the arms may become practiced in the manipulation of the device in a short time. When necessary, it may be adjusted to suit the heights of different tables or desks on which work is to be done.

Where Toothbrushes Grow on Trees

Stems from a West Indian tree that is rich in saponin, a soapy chemical that cleanses the teeth, are used by the natives instead of factory-made brushes in many parts of the islands. They are cut in sections four or five inches long, and when the end is moistened and rubbed on the teeth, the fibrous wood becomes frayed and, at the same time, a profuse lather is produced. The brushes are sold in the native market at three for a cent. When dried and ground, the wood forms a powder which is said to be good for cleaning dainty fabrics as it contains no substance injurious to them.

Motor-Driven Steel Canal Barge Looks Like Submarine

Steel barges that have the appearance of submarines coming to the surface are now plying between New York and Duluth, covering from ten to twelve miles an hour with the aid of their Diesel engines where the old mule-drawn craft made only a fifth of that speed. They are expected to lend a stimulus to the development of inland water-borne commerce, which has faded somewhat with the growth of the railroads. The boats are 260 feet long, forty feet wide and have a cargo capacity of 1,883 tons. One of their chief advantages is said to be the economy of operation, only two engineers and two oilers being necessary. Electrically driven machinery aids in loading and unloading. They can navigate the Great Lakes in extremes of weather and when the barge canal is closed by ice, they are transferred to Atlantic coastal service.

Bumper on Automobile Also Serves as Rack for Baggage

Big enough for carrying trunks, milk cans and other bulky objects as well as spare tires, a rear-bumper carrying rack for automobiles has been placed on the market. Besides space for these articles, the carrier has a bracket for the tail light and license plate, making extra attachments unnecessary. It is bolted to the body and can be put on in little time.

How Milk Cans or Bulky Trunks Can Be Carried on Wide Rear-Bumper Rack

The 100TH ANNIVERSARY of the LOCOMOTIVE

WHILE history records many great events since the discovery of America, few have done more to advance human progress than the locomotive, the hundredth birthday of which is being observed this year.

The first public railway in the world was opened for traffic in England on Sept. 27, 1825. This road was built under parliamentary powers, conveying passengers as well as coal and goods. It was a great day when George Stephenson's historic locomotive, preceded by a rider on horseback carrying a flag, hauled a train containing thirty-four cars at a speed of ten to twelve miles an hour.

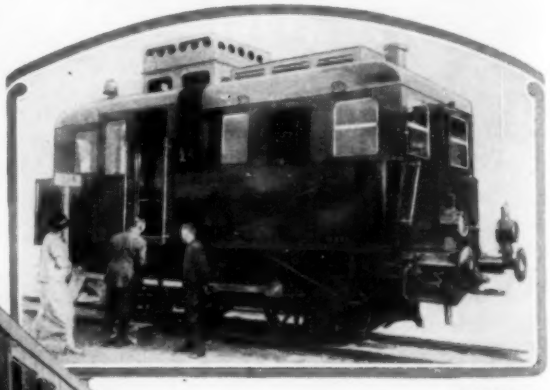
While 1925 will be publicly accepted as marking one hundred years of railway operation, there will be a number of celebrations in the immediately following years throughout North America. Conflicting claims have appeared as to what constitutes the first railway. In point of time the Pennsylvania railroad is the oldest in the United States by virtue of its charter being granted on March 21, 1823. It did not, however, start to operate until Sept. 20, 1832. Col. John Stevens is the father of the Pennsylvania, as he is the father of the American locomotive. Having seen the imperfect steamboat of John Fitch plying on the Delaware, he became interested in steam propulsion, and experimented on this for the next thirty years. In 1825, Stevens constructed a locomotive with multitubular boiler which he operated for several years on a circular track upon his estate. It carried half a dozen passengers at the rate of twelve miles an hour. This is believed to have been the first locomotive in America driven by steam upon a track.

An example of the disbelief in the new steam traction is illustrated by a test of speed between a horse-drawn vehicle on an operating line of iron track and the first steam-drawn car staged at that time. A mechanical genius named Peter Cooper had completed an engine known as "Tom Thumb." After months of endeavor he finally, on Aug. 28, 1830, got a trial of it on the Baltimore and Ohio road against the regular horse-drawn vehicle. The engine quickly demonstrated its superior speed and power, and the new mode of transportation was accepted. In years of operation the Baltimore and Ohio is the oldest on this continent, and will celebrate its centennial in 1927. While a steam railroad was first operated in 1825, engines driven by this power date back as far as 1804. Between 1804 and 1825, the follow-

ing inventors had been experimenting in England, France, and Germany: Watt, Cugnot, Hedley, Blackett, Blenkinsop, Hackworth, Trevithick and Stephenson. The last-named built a satisfactory-working engine in 1814, named "Blucher." Trevithick's engine traveled on rails at Merthyr Tydfil in 1804. But it was only after 1830 that the steam-driven engine can be said to have been an important factor in aiding civilization.

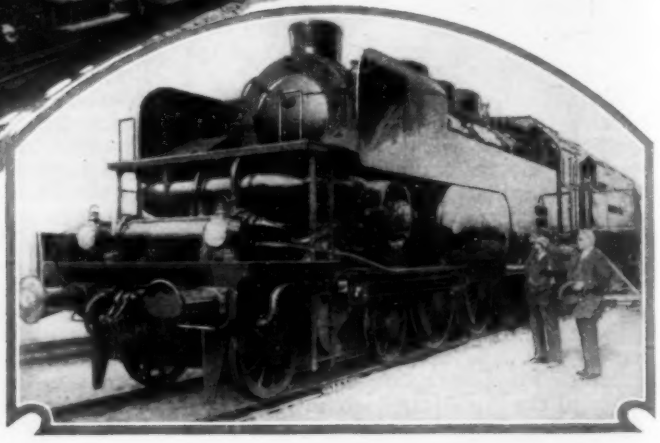
From this time on there was continuous progress in mechanical traction, and although the first locomotives were small and crude, their employment as an agent of transportation marks one of the world's greatest advances. In the course of a century, a vast wilderness on this continent has been changed from gloomy untrodden forests, dismal swamps and pathless prairies into the abode of a high civilization. Prosperous states teeming with populous towns, fertile farms, blooming gardens and comfortable homes have arisen from regions where savage men and wild animals united to maintain sterile desolation. Stephenson's first locomotive had a cylinder boiler only eight feet long and thirty-four inches in diameter, with an internal flue tube passing through it. It had two vertical cylinders and worked the propelling gear with crossheads and connecting rods. The power of the two cylinders was carried by means of spurwheels to the drivers.

Contrasted with this pygmy are the gigantic types of the present which are limited in size only by the capacities of their axles. Marvelous steps in power and speeds have been accomplished with practically no material growth in fuel consumption over that of a short time ago. In freight service iron monsters weighing considerably more than 100 tons without their tenders, attain speeds of from ten to fifteen miles an hour with fifty to a hundred heavily loaded cars.



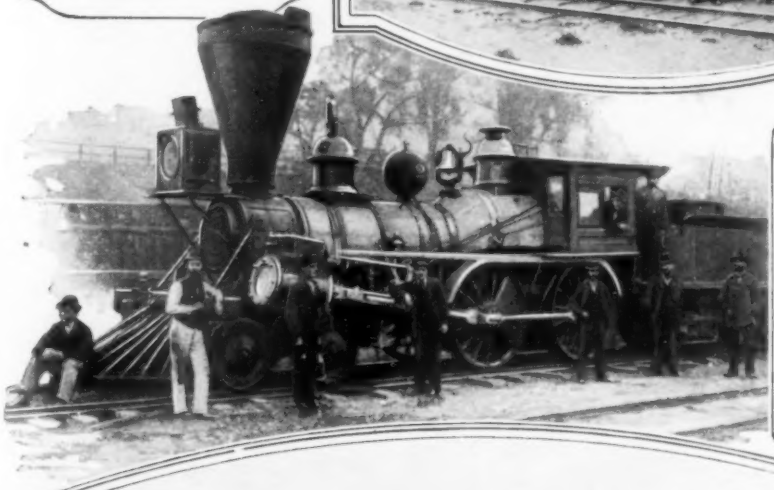
© Keystone

With the Growing Popularity of Oil as Locomotive Fuel, the Diesel Engine Has Been Introduced for Rail Travel; This Is a Late Model Exhibited at a Railroad Exposition in Berlin

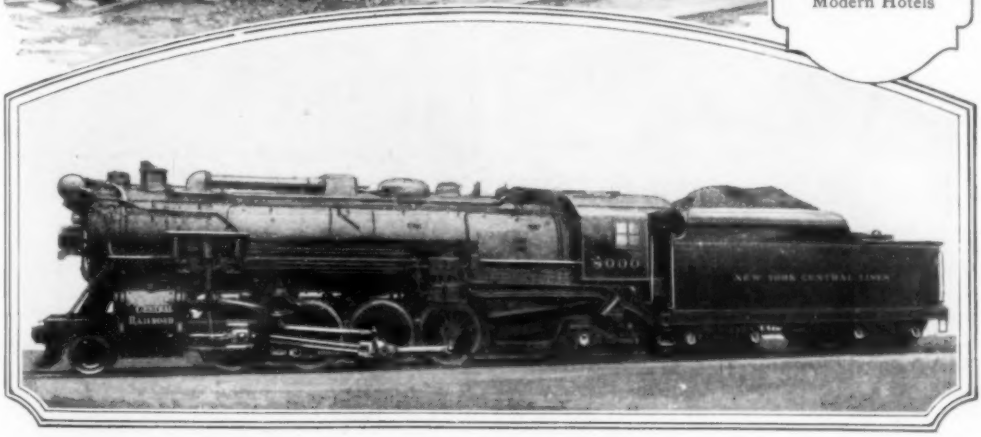


Russian Electric Train Which Travels Distances of Almost 500 Miles without Stopping to Renew Its Supply of Current; Energy Is Derived from Large Motors Producing 3,000 Horsepower Each; Right, German Turbine-Driven Locomotive, a Class Which Is Rapidly Taking a Place in the Field of Railway Transportation

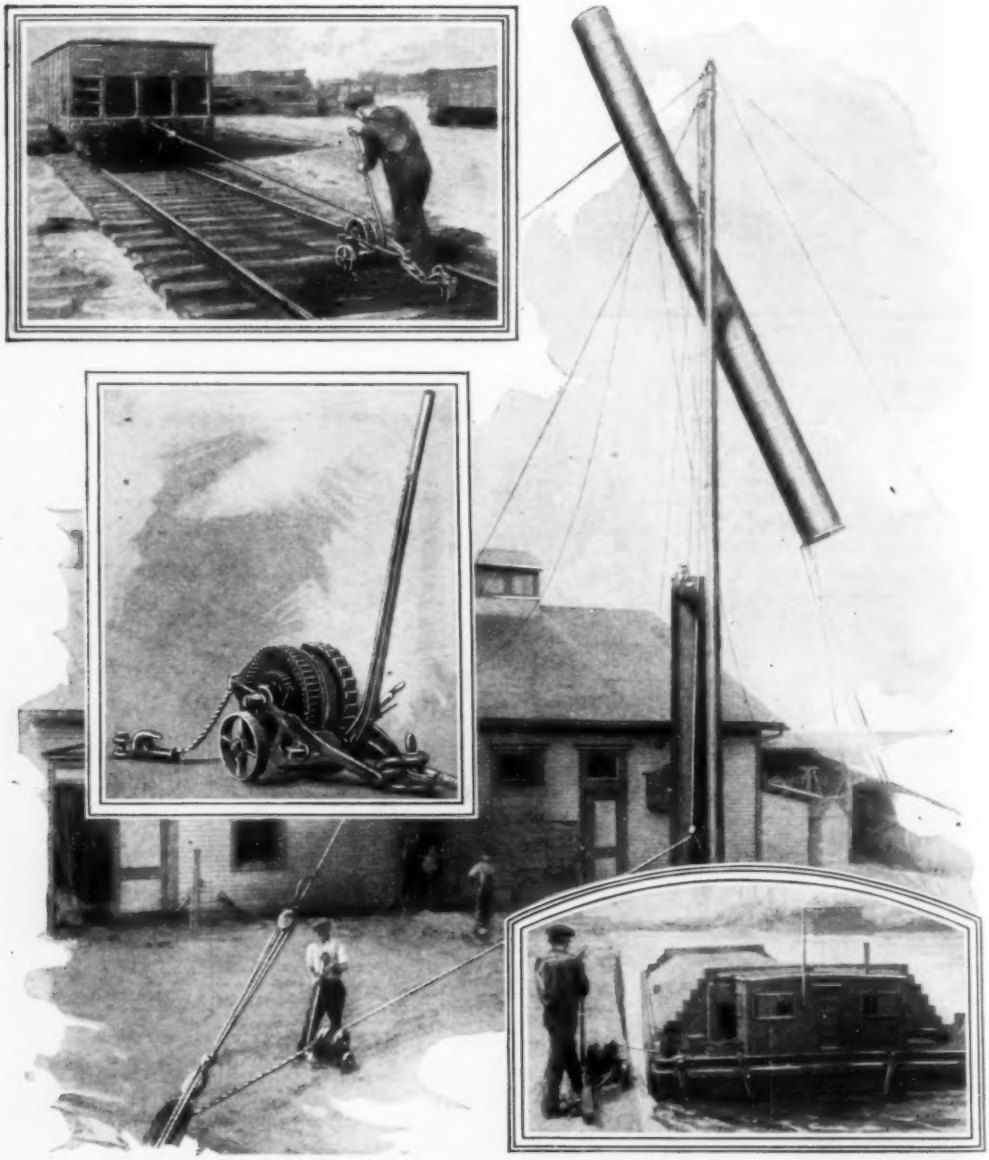
Reproduction of an Old Drawing Illustrating a Contest between an Early Locomotive and a Horse-Drawn Railway Carriage; Right, Although Coal, Oil and Electricity Have Long Been Used for Modern Railroading, a Few Ancient Wood Burners Are Still Doing Active Service in Remote Districts



Depending on Wood Which It Devoured at a Rapid Rate, This Old-Timer of 1853 Was a Marvel of Its Day; Below, Space Eater of the Type That Daily Races between New York and Chicago with Palatial Trains That Rival the Most Modern Hotels



HAND JACK AND TACKLE DEVELOP SIX-TON PULL



Typical Uses of the Jack, Shown in Center Close-Up; Moving Freight Car, Hoisting a Heavy Stack and Towing Barge, Each with Only One Man

For moving cars, clearing wreckage, setting boilers and many other similar tasks requiring heavy lifting or pulling, a portable outfit that combines the principles of a jack and winch and can develop a direct pull of 12,000 pounds with one man working a five-foot lever, has been placed on the market. It is mounted on wheels for easy moving or may be carried on the shoulders of two workers as it weighs only a little more than 200 pounds. It has a drum that can be driven at six different speeds, while a brake and reverse mechanism insure control of the load. The apparatus is said to be especially practical in building jobs that do not justify installation of power units, and its compact size adapts it to a wide range of usefulness.

Four-Bladed "Leviathan" Propellers ... responding surfaces to view and compa...

Plants Immune from All Disease Sought to Check Farm Losses

Believing that the great losses annually inflicted by plant diseases on the world's food crops can be largely reduced by careful selection of blight-proof specimens, scientists of the New York botanical garden urge students of botany and medicine to combine in a search for such vegetation. The report says it is possible many of the ills afflicting mankind may be studied in plant life. Diseases of great cereal crops are costing the country untold millions of dollars each season. Wheat destroyed by rust in one year resulted in a loss of more than $20,000,000, and damage to corn amounting to $5,000,000 was suffered by growers in Illinois alone during the same period. While spraying, dusting and seed treatment as now used are valuable helps in keeping down the losses, the expense of such processes is reflected in food costs. By breeding new and more sturdy races of plants immune to blights, and developing those species which show resistance to diseases, it is hoped to increase the healthy crops and lower prices.

House Is Moved across Cemetery on Elevated Tracks

On timber tracks raised several feet above ground to avoid contact with the tombstones, a house being moved across an old California cemetery was safely transported over the graveyard without the need of removing any of the monuments in its path. Before starting the building on the way to its new location, the mover mapped out a course for the rail supports between the graves. The runway was then elevated on blocks sufficiently high to prevent injury to the plots or the plants growing on them.

House Being Moved across Old Cemetery on Elevated Tracks to Avoid Damaging Tombstones

Chlorine Gas for Use in the Home Given by Adjustable Mask

A gas mask which generates a mild mixture of chlorine and air for the relief of colds and bronchial affections, and intended for individual use, has a charge sufficient to last several persons for two months. Equipped with a valve and regulator, the mask when applied to the nose can be easily adjusted to permit variations in the strength of the fumes. It is harmless in its effect as the entire supply is insufficient to injure the patient. Used regularly each day the inhaler is said to prevent infections of the nose, throat and bronchial area. Gas can be consumed only while the valve is open. When the tank is emptied it may be recharged.

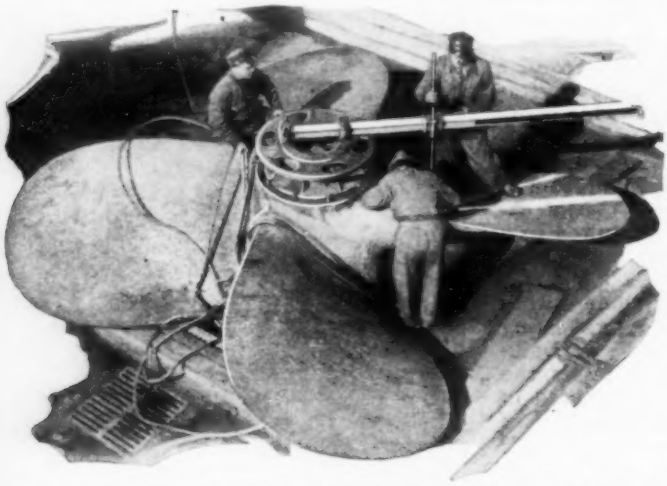
Inhaler for Home Use Which Generates Chlorine Gas for Relief of Bronchial Ailments

Talking Tape for Indoor Aerials Strung on Molding or Frame

A new form of indoor antenna, known as the talking tape, has made its appearance. The tape is very flexible, and can easily be strung around the molding of a room or wound on a wooden frame in the form of a loop. On account of its flat surface it acts as an excellent conductor of minute currents.

Four-Bladed "Leviathan" Propellers to Give Greater Speed

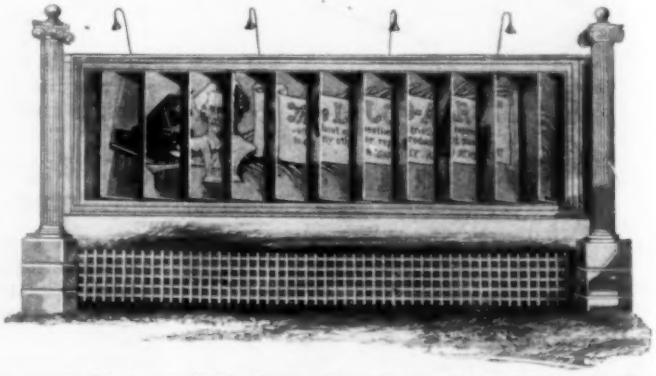
Propellers with four blades instead of three have been placed on the liner "Leviathan," to obtain greater speed and greater efficiency. The mighty "fins" are of bronze, weigh more than 35,000 pounds each and are over thirty feet in diameter. They were cast especially for the liner and carefully balanced before they were attached to the shafts so that they would run evenly, causing a minimum of vibration. The ship has four propellers.



One of the New Propellers, and Engineers at Work Adjusting It for Installation on the Shafts of the "Leviathan"

Three Signs Occupy Same Space on Automatic Billboard

An automatic signboard which displays three different advertisements in the same space is claimed to draw considerably more attention than the ordinary outdoor bulletin panel. Once installed, the board requires little or no care, as it operates by electric motor and is so lightly constructed that a great amount of energy is not needed to keep it in constant motion. The panels of the sign consist of revolving triangular drums on each side of which equal sections of the advertisement are painted. These rotate at intervals to present corresponding surfaces to view and compose a complete design. When the signs are to be replaced another set of drums is mounted in the revolving frames, necessitating but a few minutes of idle time to make the substitution. The device is said to work in all kinds of weather. Similar displays may also be made for show-window and counter use in stores.

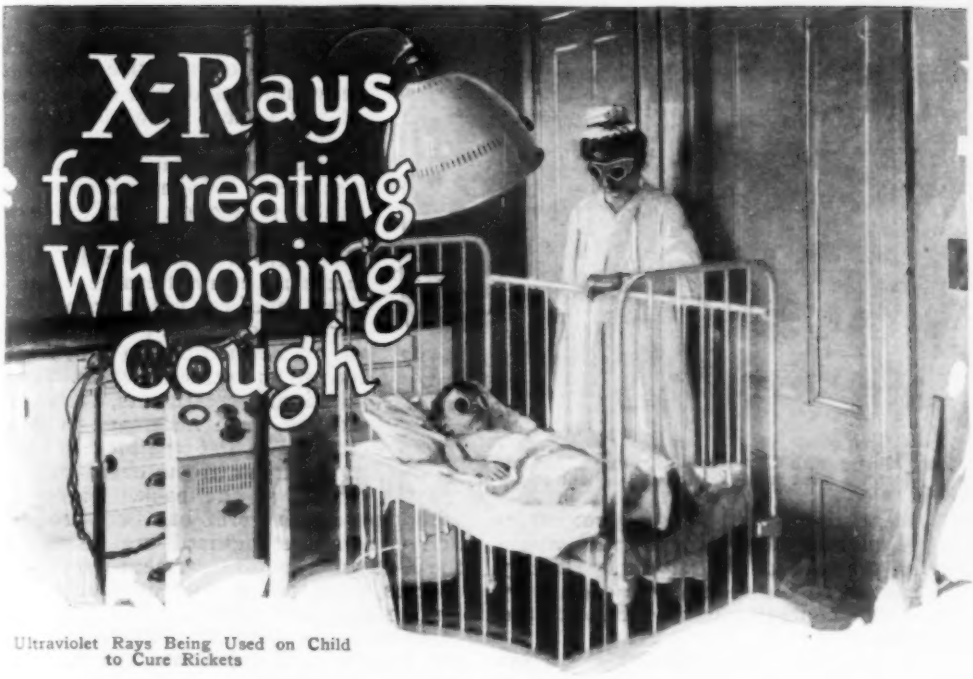


Automatic Signboard Which Displays Three Separate Advertisements on Triangular Sections Revolved by Motor

More Forest Trees in Kansas Now

The state of Kansas has more forest trees today than were found when settlers took possession of the territory, according to Prof. Albert Dickens, of the Kansas State Agricultural College, who said when pioneers entered that country great tracts of woods had been burned over by the Indians as a means of creating barriers of waste land against other hostile tribes. This repeated destruction resulted in killing off most of the young trees, and growths were confined to sparsely covered areas bordering on the streams. Settlers prohibited the practice and the timber began to spread. Homesteaders were then required by the government to plant trees on each section of land taken up. Many pioneers introduced seeds which produced large crops of valuable lumber. Residents of the state are planting trees in available spaces and combine with the forestry patrols in preserving the timber stands by aiding in combating fires.

X-Rays for Treating Whooping-Cough



Ultraviolet Rays Being Used on Child to Cure Rickets

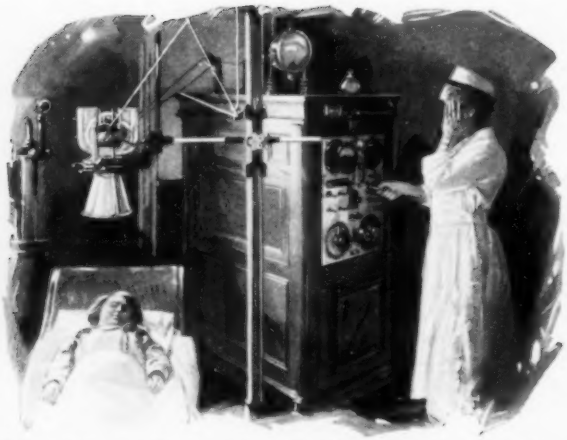
By F. N. HOLLINGSWORTH

THERE are over 6,000 deaths in this country every year from whooping cough, and medical authorities rank this disease as one of the highest in the infant-mortality statistics of the country. These figures are necessarily incomplete, for many communities do not class it as a reportable disease, and therefore keep no records of it. As every mother knows whooping cough is regarded as highly infectious, and the periods when it is epidemic in a neighborhood are anxious ones for them.

However, an effective method of treatment, which, in the large majority of cases, proves a cure, and in practically every case effects great improvement, as well as arresting the progress of the disease, has been found, it is believed. In the last two years, 700 cases of whooping cough have been treated by means of the X-ray or Roentgen ray, at the "On-Shore department" of the Boston floating hospital, with only two deaths, these being of babies under one year old, where the disease was complicated with pneumonia. So successful has this X-ray treatment proved at this hospital, where it was first used, that it has now been taken up by institutions in New York, Chicago, San Francisco and Montreal. Whooping cough is practically an all-year-round disease, but reaches its peak between January or February and June, according to weather conditions and the section of the country. If one has not had it in childhood, it frequently seizes a person when full-grown, but having once gone through it, one is practically immune from a second attack, according to past records. It is among infants and very young children, however, that the bulk of the cases occur, and death most frequently results.

This new X-ray treatment was discovered entirely by accident, as it were, two years ago. Everything had been tried in the way of treatment with little success, and finally Dr. Henry I. Bowditch of the Harvard medical school, physician in charge of the hospital, decided to try the Roentgen ray. It was found that from fifteen to twenty per cent of the cases so treated showed prompt improvement, the convulsions stopping within twenty-four hours. The remaining eighty per cent of cases treated in the two years showed definite improvement, with the exception of the two infant deaths mentioned above.

The time of exposure varies in individual cases, according to the distance of the ray from the patient, the thickness of the aluminum filter, and the strength or intensity of the current used. Actual exposure is from two to five minutes at each



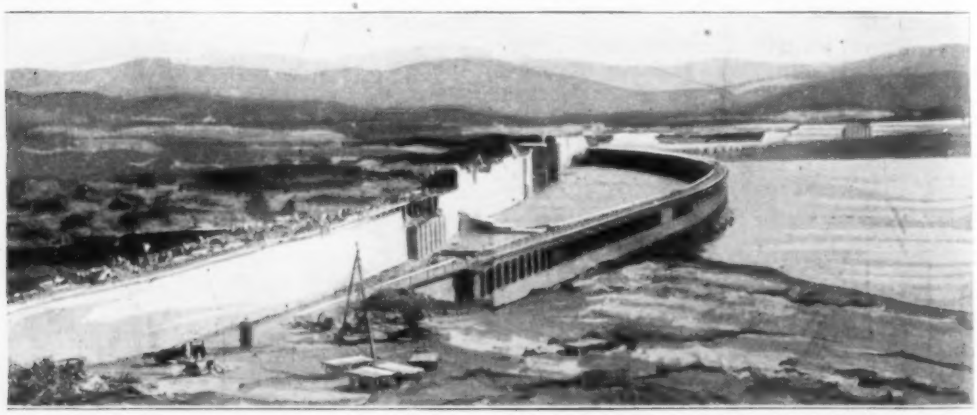
Using X-Rays with Protective Aluminum Filter on Whooping-Cough Patient from Two to Five Minutes at a Time

treatment, the "dose" being approximately one quarter of the amount that would redden the skin of the patient. The ray is localized to the seat of the disease by means of a cone, inside of which is placed the filter.

The apparatus used consists of an ordinary high-tension transformer, with a rectifying device, a universal Coolidge tube and a treatment stand, with cones of such size and shape as would include the entire chest of the patient at a distance of twenty-eight inches. The patient reclines on a couch during the treatment. When desirable, particular protection is afforded to the thyroid gland by covering the gland area with sheet lead. Treatments are every alternate day until three have been given, with a similar second course after an interval of seven days in more protracted and resistant cases. These additional treatments, however, did not seem necessary in most cases. The first treatment is given at the front of the chest and the second at the back. Since the whooping-cough germ has been isolated and is a well-recognized organism, and the X-ray method of treatment is a proved success, attention is now being given to finding out just why the X-ray effects cures and improvements. The ultraviolet ray is also used extensively in cases of rickets and joint diseases.

Irrigating Dam One Mile Long to Water a Million Acres

About 100 miles from Bombay, India, one of the largest irrigation projects in the world is nearing completion as the last rocks in the dam, one mile long and 170 feet high, are being put in place. The lake which this barrier will form will be eighteen miles long and forty-six miles in circumference. Its waters would cover an area fifteen miles square to a depth of 143 feet, sufficient to irrigate approximately 1,000,000 acres. If the rocks in the dam were placed end to end, they would reach halfway around the world. Two canals, longer than the Panama, will distribute the waters to the farms. At the site of the dam, the rainfall averages only forty inches a year, but the lake will extend to a district where the fall is more than six times that amount.



Courtesy The Sphere

Milestones of Engineering Progress in India, the New Irrigating Dam, Seen as a High White Wall Being Erected in Front of the Old Arched Structure at Right

Artificial Sunshine in Zoo Keeps Tropical Birds Healthy

London fogs, notorious for their thickness, have often proved fatal to the more weakly tropical birds at the London zoo. To offset the effect of the unaccustomed clammy darkness, electric lamps fitted with fused-quartz globes have recently been installed to provide artificial sunlight in the bird house. Fused quartz, unlike ordinary glass, does not cut off the ultra-violet rays, and therefore duplicates the actual effects of real sunshine. Heavy fogs cause the tropical birds to "go off their feed" and they sit and mope until they die. The artificial sunlight, however, keeps them healthy and interested in food. The quartz lamps have also been found useful in the reptile-house laboratory to get snakes and lizards to eat. The reptiles make every effort to crawl into the zone of the rays, and when there quickly recover their appetites.

Silhouette at Broadcasting Station Duplicated by Unseen Audience

Two Hundred Inventions Daily

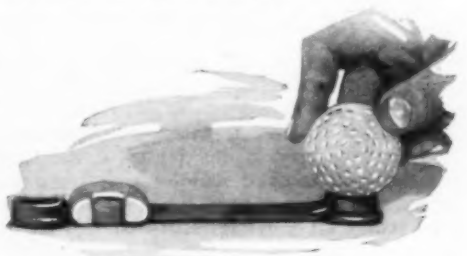
Reports of the patent office for 1924 show that applications were received at the rate of about 300 a day and that some 200 were granted daily, including designs and trademarks. Those issued totaled 63,062, an increase of nearly 6,000 over 1923, and the number of applications was 101,134. The office reduced the number of applications awaiting official action by nearly 12,000 and lowered the average time to four and one-half months for new work and to between three and four months for old work. All fifty-four divisions of the office were less than eight months behind at the close of the year, while on January 1, 1924, twenty divisions were more than eight months in arrears.

Radio Fans Draw Wireless Picture Broadcast by Artist

An interesting experiment was recently conducted by station WLAG by broadcasting a silhouette of a profile photograph of Miss Eleanor Poehler, the managing director. The listeners were instructed to draw thirty-five vertical and horizontal lines, spaced across a sheet of paper. The vertical lines were designated by letters and horizontal lines by numbers. A profile photograph was then placed on a similarly ruled sheet and a dotted outline was made. The exact location of each dot was broadcast so that the listeners could put them on their sheets and join them to form an outline duplicating the original, leaving the shaded portion to be filled in at leisure.

Double Golf Tee Made of Rubber Provides Two Heights for Ball

Golf tees with two sockets for the ball, one close to the ground and the other slightly higher, afford variations in practice strokes, save time and promote accuracy in the use of the clubs. The tee is a bar of rubber, with a "well" for the ball at either end and a weight to retain it.



Adjusting Ball on Higher Socket, with the Weight near Lower One, Out of Club's Range

Copyright, Underwood & Underwood

Setting the Clock Which Automatically Starts Radio Set or Phonograph on Combination Instrument

Combined Clock, Radio, Phonograph Gives Music at Any Hour

A radio receiver, phonograph and clock have been combined so that the owner may have music at any predetermined hour. The wireless set has four tubes and may be operated independently, although the clock is the heart of the apparatus. The entire instrument is sixty inches high, eighteen wide and fourteen deep. The radio uses dry cells and the phonograph is operated by an electric motor. It took two builders no less than five months to construct the instrument.

Balance Scale Finds Ore Deposits by Pull of Gravity

Information concerning the location and size of subterranean ore and oil deposits may be obtained by an instrument that makes extensive surveys and soundings unnecessary. The device, consisting of a delicate balance scale, which has been demonstrated in Australia, also indicates the formation and structure of the earth at any given point for a considerable depth. Application of the instrument to a prospected territory is said to greatly reduce the cost of drilling, since surveyors can gather data regarding the most favorable spots and localities for soundings, and its use may eliminate large numbers of borings and exploration shafts both in the search for oil and in ordinary mining. By measuring the distances between points where scale readings change, due to the variation in the influence of gravity set up by different minerals, the extent of the deposits can be quickly approximated.

Autos Run through Ten-Foot Sewer to Carry Inaugurating Party

About eleven years ago, the city of Bradford, England, began the construction of a huge sewage tunnel, three miles long and nearly 400 feet below the surface. The work was completed recently, and arrangements were made for the ceremony of laying the last brick. Then the problem arose, how to get the inaugurating party to the scene. The circular tunnel, ten feet in diameter, presented a steep and slippery bottom for any vehicle and walking was out of the question. Several motor cars were tried, but failed to make the journey. Finally a concern making a light, small automobile offered to take the party to the tunnel center. Four cars were used and, with skillful piloting, were sent through the sewer at the rate of twenty miles an hour without mishap.

Auto Emerging from Its Trip through Sewer, Kept from Bottom Channel by Careful Steering

Washing Air for Homes

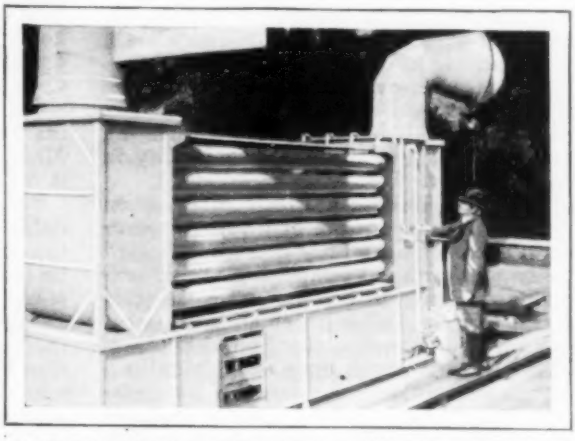
A HOME which is kept perfectly ventilated at all times with all windows closed, while the circulating air is washed clear of dust and germs and kept moistened or dried to a predetermined relative humidity has been built in California by Prof. Willis Luther Moore, for more than eighteen years chief of the United States weather bureau.

Inside the dead-air space of the usual home walls he has constructed a live-air space through which the ventilating currents pass. The live air, admitted through a register on the roof, passes through all the walls and ceilings, and out again through another roof register.

In addition there are two funnels on the roof, looking much like the ventilators on a ship, except that a vane keeps one always pointed into the wind, as an intake pipe, and the other away from the wind, as an exhaust.

After entering the intake funnel on the roof the air is cooled by passing through a series of thin copper pipes that are kept wet by a spray of water, the pipes being covered with a fibrous material which acts like the covering on an army canteen, cooling the air inside through the water evaporation on the outside. The pipes themselves are located on the roof, between the funnels, so that the passing air helps evaporation. From the cooling coils the air passes through a series of washing and moistening pans, which wash it clean of all impurities and at the same time raise the humidity. After washing, the air goes down conduits running from the roof to each room in the house. The conduits have an inlet to each room through a small register placed in one corner of the ceiling, while in the opposite corner an outlet register is located, with a conduit leading to the exhaust funnel.

The ventilation is so gentle as to be almost imperceptible, a steady, cool and moist current falling from the inlet register, and the used air rising on the opposite side of the room to the outlet. While the movement is almost imperceptible to the senses, an air meter attached to the inlet spins rapidly, as proof that considerable air is passing. Both the house and yard are equipped with thermometers and hygrometers to keep a written record of



Air-Scrubbing Unit on House Roof with Intake and Discharge Funnels That Offer Path of Circulation for Wind Currents

Moist-Air Radiators Diffuse a Soothing Atmosphere and Can Be Easily Changed to Dry Heaters to Control Humidity

the temperature and humidity. On a sample day the relative humidity out of doors was 31 per cent, while in the house it registered 79 per cent.

The system is sufficient to change the air in all rooms every forty minutes, or, by turning on an exhaust fan located at the roof, it can be speeded up to a complete change of atmosphere every eight minutes.

Besides the novel ventilating system and the circulating live air in the walls, Prof. Moore has also perfected his own heating system, to insure the proper humidity in cold weather.

"Air that may be healthily moist when taken from the outside at a low temperature, becomes harmfully dry when heated to a comfortable temperature," he explains. "Human beings suffer in this warm, dry air, suffer a depletion of nervous and vital energy through the excessive demands made upon the ducts and glands of the body to maintain its moisture. My heater is a specially designed humidifying or moist-air radiator, which heats through the diffusion of water vapor."

The radiator consists of four pan units, each four feet long, four inches wide and four inches deep, through which pass the pipes carrying the steam or hot water. The pans, covered with fine screens, are partially filled with water, the water level being kept constant by a float valve operating the inlet pipe. The steam or hot water passing through the water pan gives off its heat, and at the same time evaporates enough water from the open pans to maintain the humidity. The valve arrangement is such that the pans can be readily emptied and the system changed to a dry air heater, if desired.

"These radiators produce a moist, soothing atmosphere, instead of the irritating and nerve-racking heat that comes from ordinary radiators," Prof. Moore explains. "It is probable that nothing conduces more to increase in the death rate than the excessively dry air of the living and sleeping rooms of winter in climates where there is a wide difference between the temperature on the outside and that on the inside, and the use of individual gas heaters, burning up the oxygen of a room, and always liable to give off the deadly poison monoxide. One may shiver and feel colder in an air seventy-five degrees in temperature and with a relative humidity of forty per cent or less than one would in an atmosphere of sixty-eight degrees with a relative humidity of sixty or seventy per cent.

"The moist-air radiators in my new home communicate heat largely through the diffusion of the water vapor rather than the radiation of dry heat, with a decided gain in health and vitality, and a marked saving in the expense of fuel. Moist air holds its heat and slowly loses it, while dry air cools rapidly."

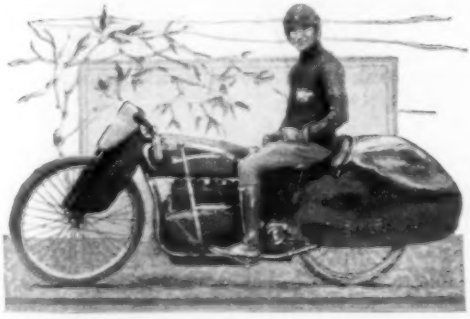
"Were the homes of the people that inhabit the dry regions of California and the other states of the Rocky mountains," he adds, "supplied with properly moistened air, an enormous gain in health and productive efficiency would come to them, and in all new construction provision should be made for installing a system for automatically and inexpensively washing and cooling the air in summer and thoroughly ventilating every room in a place of habitation."

Half of Nation's Electric Power Now Used in Homes

Although the first incandescent lamp was not marketed until about 1880, the annual sale of electric appliances for the home is now estimated to total more than $1,000,000,000, according to a report of the National Bank of Commerce in New York. The total sales of electricity for residential, industrial and public-utility uses for 1924 amounted to approximately $1,335,100,000, a sum $65,100,000 greater than that of the preceding year. Of the electrical goods sold by retail stores, practically ninety per cent is purchased by women.

Motorcycle with Streamline Body Speeds Two Miles a Minute

What is said to have been a world's speed record for motorcycles was made in California recently when a four-cylinder stock machine, with special streamline body and supercharging apparatus, covered a quarter-mile stretch at the rate of 127.1 miles per hour. The frame was shielded to reduce wind resistance, the design being made by one of the men who constructed the round-the-world airplanes, and the motorcycle was piloted by an experienced automobile racer. Further attempts at lowering the speed mark are to be made to test the machine's equipment and the effect of streamline patterns.



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Motorcycle with Body Tapering Off Behind, Reducing Front Wind Resistance

Pocket Pliers Shaped Like a Wrench to Increase Gripping Power

Adjustable pliers that fit the hip pocket and are constructed somewhat like a monkey wrench, with protruding notched jaws for gripping round, square or hexagonal surfaces, have been placed on the market for mechanics, repairmen and others who desire a tool that will not slip and will stand great strain. A pair of this pattern is said to have greater capacity and more power than one twice its size and will bear 500 pounds' pressure applied to the handles. By slipping the lower grip into its slotted groove, the jaws are quickly adjusted for articles of different size, and this feature makes the pliers well adapted to many tasks about the home. The jaws also can be adjusted to form an opening for closing tire-chain links.

Holding Full Weight from Plier Wrench Fixed to Nut, to Show Tool's Strong Grip and Safety from Slipping

China's Trade in Bones

For many years, the economical Chinese have put animal bone to good use for various ornamental and practical articles and for fertilizer, but the traffic in this commodity in recent times has greatly increased so that now they are said to be importing large quantities. During the first six months of 1923, Shanghai alone imported nearly 1,500 tons of cow bone valued at more than $238,000, principally for tile-game makers. In 1922, China exported more than $1,000,000 worth of bone.

Medicine Taken through the Skin to Avoid Unpleasant Doses

With a new electrical apparatus, drugs and medicines, it is said, can be administered through the skin, so that distasteful doses need not be taken through the mouth. The method is claimed to eliminate waste and secure more rapid action, as the substances do not have to pass through the stomach. The instrument is, however, intended principally for use in treating local ailments.

Taking Medicine with the Electric Doser That Is Said to Force Liquids through the Skin

Nation's Seventeen Million Autos Valued at Ten Billion Dollars

Official registration figures from all the states show that at the end of 1924, there were 17,700,179 autos in this country, an increase of about sixteen per cent over 1923. On the basis of a population of 114,000,000, this means that there is a passenger car or truck for nearly every sixth person. The money invested in the vehicles is estimated at $10,620,107,400. The total production for the year was placed at 3,580,000 cars, of which about 300,000 were exported. New York led in registrations with a total of 1,412,050, California was second with 1,321,480 and Ohio third with 1,237,000, closely followed by Pennsylvania and Illinois, each with over a million motor vehicles.

Oil Drawn from Potatoes Reclaims Waste Unfit for Food

A process for extracting oil from potatoes unfit for food has been invented in Australia. Tubers in various stages of decay may be treated to yield a colorless and odorless material especially valuable for lubricating delicate mechanisms such as are found in scientific instruments and accurate balances. The low freezing point of the oil is said to make it adaptable also for airplane engines and instruments. The process is inexpensive and simple and does not require large manufacturing facilities. It is claimed the method will greatly reduce the losses from spoilage in potato-growing districts by reclaiming vast amounts of waste.

Granite Block Cut from Mountain Is Forty Feet High

One hundred thousand cubic feet of solid granite were quarried at one time when a giant block was blasted from Stone Mountain, near Atlanta, Ga. Huge as the piece was, it represented but a tiny chip from the mountain itself, a massive monolith rising some 1,700 feet above sea level and measuring nearly a mile from the base to the top. The steepest side of the mountain is being carved with equestrian figures of Gen. Lee and other southern leaders as a monument to the Confederacy. The drill holes and the black burns left by the blasting powder that tore the big chunk from the cliff, are plainly visible on its end.

Granite Block Big as a Barn, with Drill Holes Made for Blasting Showing on Dark Surface in Center

Two Thousand Miles By Water Flivver

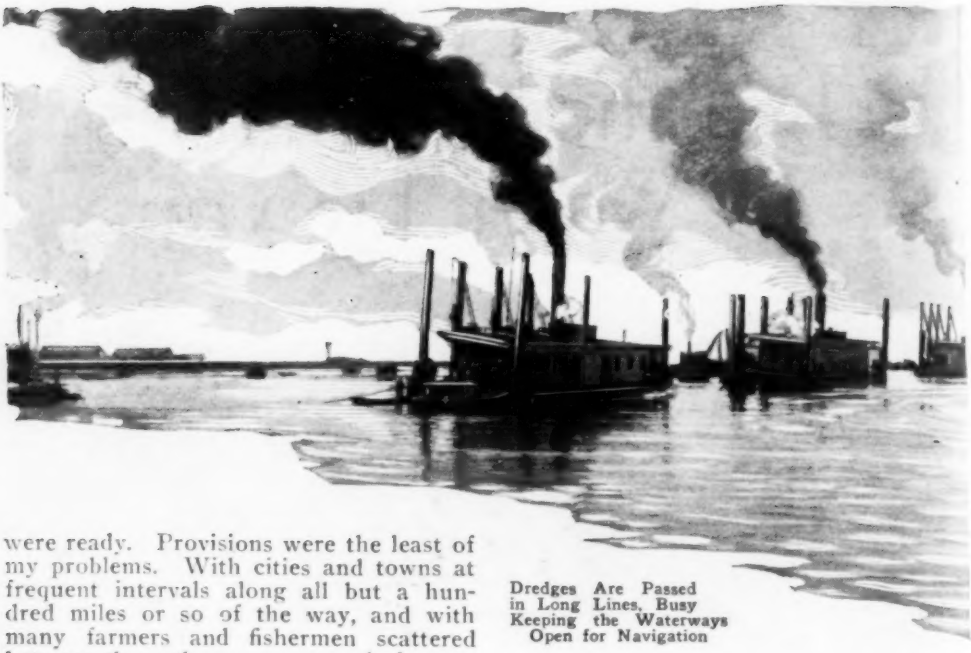
Running with Spray Hood for Stormy Weather Laid Flat

By LEWIS R. FREEMAN

MAKING a 2,000-mile trip from Milwaukee to New York with an outboard motor and an eighteen-foot skiff offers the lure of adventure and a way of avoiding the discomforts, dust and congestion of the motor highways.

As I had no companion, my transportation unit was limited to one which I could navigate and also take out of the water alone if overtaken by storms. So I selected an outboard motor with an oak-ribbed eighteen-foot boat. In order to keep from being forced to shelter in rough weather, I had this craft decked over four feet back from the bow, forming a closed, but not water-tight forward compartment. After debating the advantages and disadvantages of a built-in gasoline tank, with a pump to fill the engine tank, I decided in favor of carrying two spring-top three-gallon cans, and two one-gallon cans specially fitted with a three-foot length of one-inch hose for filling in rough water. Also I added a canvas canopy to throw off the water that would find its way over the decked-in bow. This formed a combination spray hood and extendable boat cover. It was made of heavy waterproofed canvas, with fittings to button it to the coaming of the cabin and under either gunwale. Full extension of the cover was only intended to convert the boat into a dormitory. This carried the canvas all the way back over the tilted engine. Made fast along all the windward side and the stern, and with a lee corner open for ventilation, the snuggest and most comfortable sleeping quarters imaginable

La Salle Raising the French Flag and Claiming the Great Lakes Country



Dredges Are Passed in Long Lines, Busy Keeping the Waterways Open for Navigation

were ready. Provisions were the least of my problems. With cities and towns at frequent intervals along all but a hundred miles or so of the way, and with many farmers and fishermen scattered between them, there was no need of carrying more than three or four days' food supply at any time.

As something which might prove useful in emergencies, I carried a sixteen-pound mushroom anchor, but was lucky enough not to have to use it to hold the boat off an iron-bound lee shore on all the trip. A folding canvas bucket served the dual purpose of bailer and potential sea anchor, to be cast over at the end of a hundred feet of line to hold the head to the wind in the event of the disablement of the engine.

Coming under motorboat classification, I had to carry two cork life preservers, a fire extinguisher and a foghorn to satisfy the regulations. As the life preservers were not pleasant to wear, I stowed both where they would serve to sustain the boat in case of an upset and kept at hand a comfortable and fairly buoyant kapok jacket against possible emergency. I never used the foghorn for the purpose for which it was intended, but it did prove useful in trumpeting to drowsing lock keepers. The fire extinguisher was called into use only as a biscuit-dough roller.

Except for one heavy thunderstorm of semicyclonic character, of which I only caught the tail end above Sheboygan, the first four or five days following my departure from the Milwaukee yacht club were either windless or of light and variable breezes. In easy comfortable runs of sixty to seventy miles a day, I ran up along the pleasant sandy shores of the west coast of Lake Michigan, through the Sturgeon Bay canal to the limestone-cliff walled Green Bay.

From Manistique, I started off along the direct steamer track to the straits of Mackinac, eighty miles as the crow flies. Running at an easy seven and eight miles an hour, I skirted the coast fairly closely for thirty miles. Then, with the sky still clear and the stiff following wind only serving to accelerate my progress, I headed out on the steamer track. By noon, the low northern shore was a misty streak abeam to port, with the rapidly developing sou'wester driving up a white-capped sea that splashed a disturbingly generous amount of water over the starboard quarter. Another half hour, with solid green water coming over at every lurch and both hands so busy at the lines of the kicking tiller that they were only available for increasingly infrequent dabs with the bailing bucket, I turned and headed straight before the wind and seas for the dim blurred line of the shore.

Running directly before the wind, the seas decreased for a while the rate at which water was coming over the side, but at the same time started a violent yawing which increased the risk of an upset. My bailing-bucket sea anchor performed nobly in holding the head to the wind when a dying cough told of an empty tank, and the gallon can and tube worked precisely as planned in refilling. With no chance

Passenger Steamers Are Met Everywhere Going up and down the Lakes

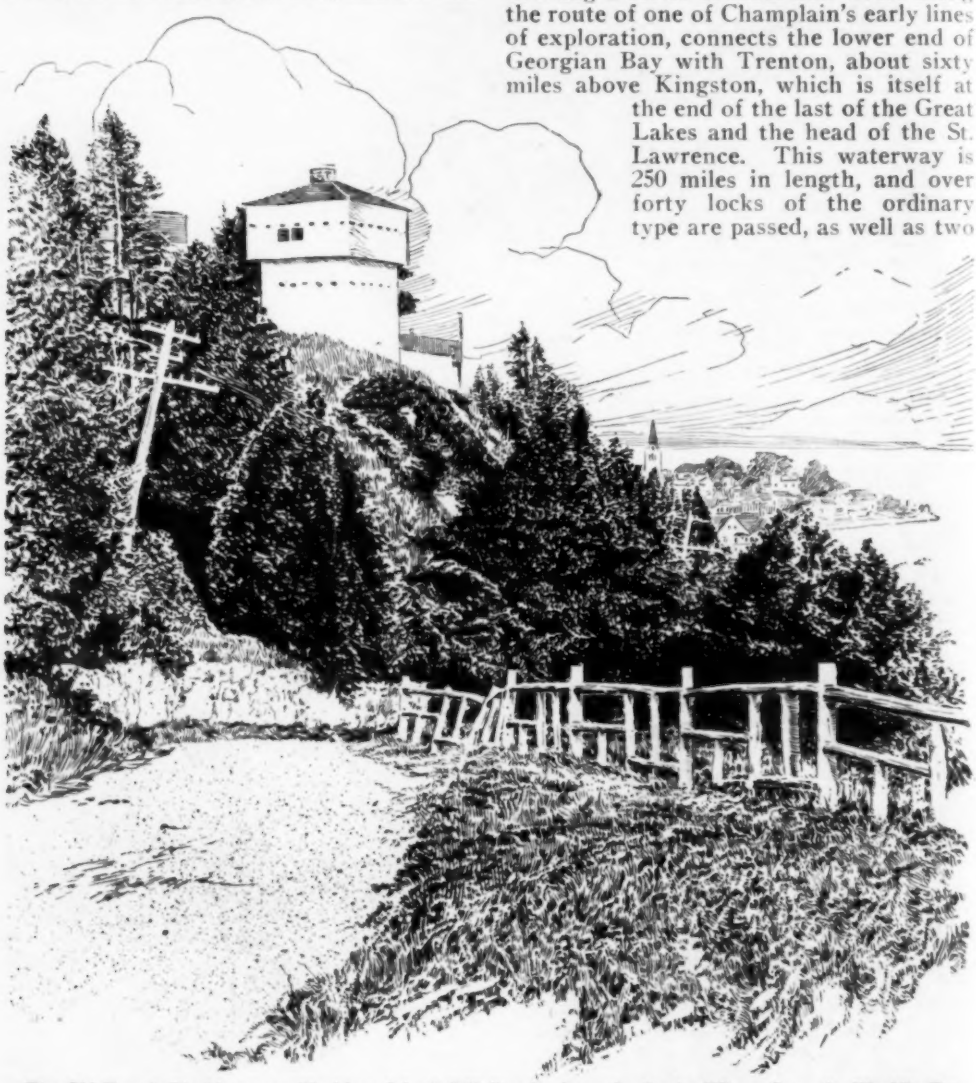
ers, I laid to my oars and ran in through the surf. My boat was rather more than half filled before I had dragged her to a point where the spent combers ceased to menace her. The next day, after running a couple of miles across a mounting beam sea, I rounded a jutting point to unroll and consult my chart, it was not long before my position became very doubtful, and only more sharply breaking combers revealed the presence of the very extensive reefs and shoals I knew to exist on every side. Nothing in the way of a bay opened up as the line of the coast became more distinct, so that the only thing left to do was to pick the least forbidding stretch of beach and head in for it like a gull at a gate.

With rocks fanging the breakers almost all of the way along the slightly curving shore line, a hundred yards of sandy beach offered at the last the best chance to avoid smashing up before my boat was near enough to drag out. Shutting off and tilting the motor at the outermost of a 300-yard side zone of break-

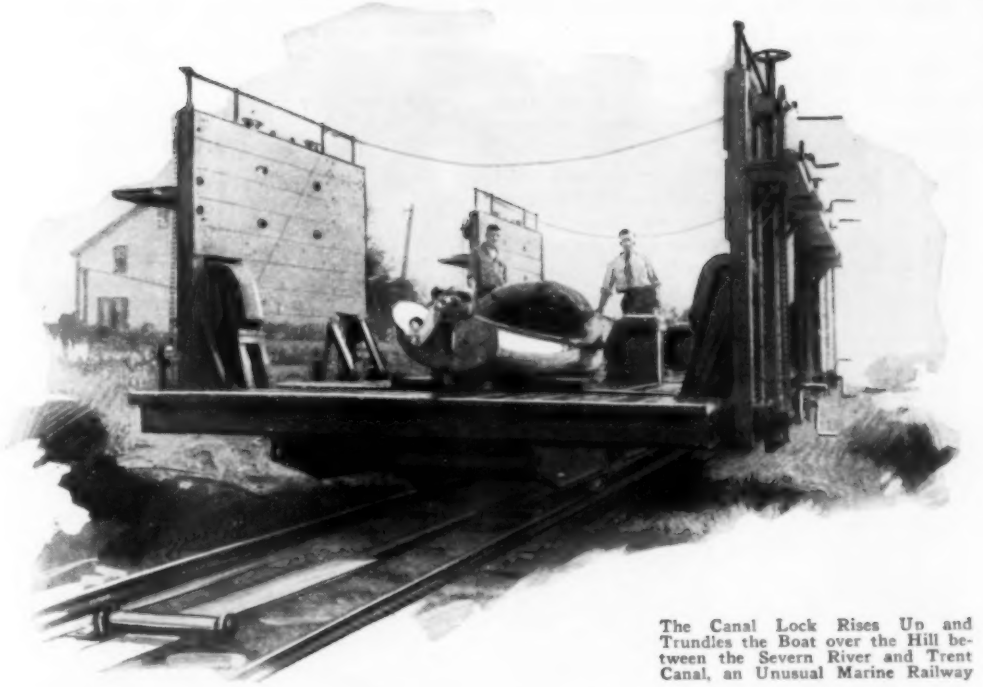
to find a protected mooring behind the crumbling breakwaters of the half-ruined town of old Naubinway. Here I was held three days and a half before an abatement of wind and sea allowed me to put out again, and even then a squally afternoon held me down to a short fifteen-mile run to quaint Epoufette. The next day I ran forty-five miles to St. Ignace and historic Mackinac Island, where again a hard sou'-wester kept me in port for a further twenty-four hours.

The next day I started early and, eating both breakfast and lunch in the boat, ran continuously until the late afternoon found me at Cockburn Island, and for the first time in Canadian waters. Both the chart and the fact that my sixth gallon tank of gasoline was half exhausted indicated a day's run of over eighty miles, much of it through the reef-foul waters south of Drummond Island.

There was a menacing turret of cloud boring in from the southwestward as I ran through False Detour passage, rounded the northwestern cape of Cockburn Island and tied up in the lee of a shambling old lumber dock. After three days' delay due to bad weather, the ninety-mile run to Little Current, at the mouth of Georgian Bay, was made in a day. The Trent canal, utilizing a series of lakes and rivers along the route of one of Champlain's early lines of exploration, connects the lower end of Georgian Bay with Trenton, about sixty miles above Kingston, which is itself at the end of the last of the Great Lakes and the head of the St. Lawrence. This waterway is 250 miles in length, and over forty locks of the ordinary type are passed, as well as two



The Old French Blockhouse on Mackinac Island Still Stands above the Straits Where Once the World's Fur Trade Was Fought for by French, English and Later, Americans



The Canal Lock Rises Up and Trundles the Boat over the Hill between the Severn River and Trent Canal, an Unusual Marine Railway

great lift locks and two marine railways. The Bay of Quinte, which I traversed from Trenton to the Thousand Islands, was swept by violent southerly winds, so that I had a very rough run. The winds shifted to northerly as I emerged from the Thousand Islands, and I had to beach twice to keep from swamping. By running the comparatively easy upper rapids of the river instead of wasting time in the locks and canals, I had no difficulty in making the 180 miles between Kingston and Montreal in not much over two days' running time.

The Big Soo rapids and the Cascades have some heavy water and I felt safer in passing them by the canals. Lachine would have been easily runable, but I had to follow the canal in order to reach a mooring near the center of Montreal. Here I replaced a battery for the first time, one cell having served for the entire 1,500-mile run from Milwaukee. It was weakened but still, in an emergency, could have served quite a while longer.

A run in fast moving water carried me forty-five miles down the St. Lawrence to the mouth of the Richelieu at Sorel, which beautiful and historic stream I followed for a hundred miles to its source in Lake Champlain. Ten old and picturesque locks lifted my boat over the more precipitous stretches of a stream which has been a highway of travel and commerce since the French first settled in Canada.

Passing the American customs at Rouse's Point, I ran over a hundred miles before a northerly wind up Lake Champlain in a single day. The following afternoon I entered the Champlain canal at Whitehall, and passed a series of locks which carried me by the New York barge canal to the Hudson. Passing through the lock at Troy, I found my boat drawn seaward on the outgoing tide, which has a rise and fall of several feet against the first of the Hudson's dams, 150 miles from New York. After spending a Sunday in Albany, I resumed my voyage the following morning. Three days later —which included a day's lay-over at Tarrytown—I headed into the swift tide of the Harlem, bucking it with my still steadily hitting little motor until Hell Gate was passed and I had won my way to a quiet mooring at a boathouse under Flushing bridge.

In looking back on what was beyond doubt one of the most interesting and enjoyable trips I have ever made, it seems to me the most significant fact about it is the one I cited at the outset—that it was made with an outfit any good outdoor man could buy and run. I only hope many of them will.

Mail Box on Front of Street Car Speeds Up Collections

Letter writers of Barkingside, Eng., who miss the postman's calls with their mail can insure its delivery on schedule time by depositing it in a mail box attached to a street car which makes regular trips to a postal center. Passengers with matter to be posted are saved the trouble of seeking a letter box on their way to the car line by having the parcels carried to the exchanging points by the same trolley they ride in. After the last collections for the day are taken up in the district, the street-car mail box is available for an hour.

© P. & A.

Mail Box on Front of Trolley Car, Which Helps Speed Collections of Postal Matter

Rubber Link Chains for Auto Tires

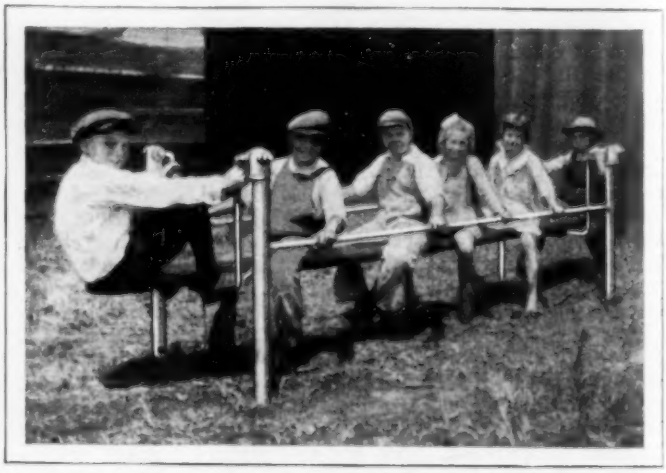
Chains with long cross links of rubber and fabric instead of metal have been offered for use on auto tires to stop skidding and eliminate the clanking and rattling of the usual equipment. In the ends are vulcanized small metal fasteners that hook into the long chain sections and hold the rubber snugly against the tire. For a four-inch tire, only twelve or fourteen links are needed to encompass it. Neater appearance, longer wear as well as silence are claimed for them.

Great Salt Lake Waters Expanding Weather Bureau Finds

That stranded ocean of the desert, the Great Salt lake in Utah, is reported by the weather bureau to be passing through another period of expansion. The waters are rising over railroad tracks, farms and highways near by, and are causing considerable trouble. The movement is not a new phenomenon, for between 1850 and 1870, the lake area increased from 1,750 to 2,170 square miles. Since then, its level has been falling, but now the action is reversed. With these changes, there have been variations in the salt content between fourteen and twenty-two per cent. The present average depth of the lake is said to be six feet four inches.

Swing Rocks Like Boat on Waves Providing Fun and Exercise

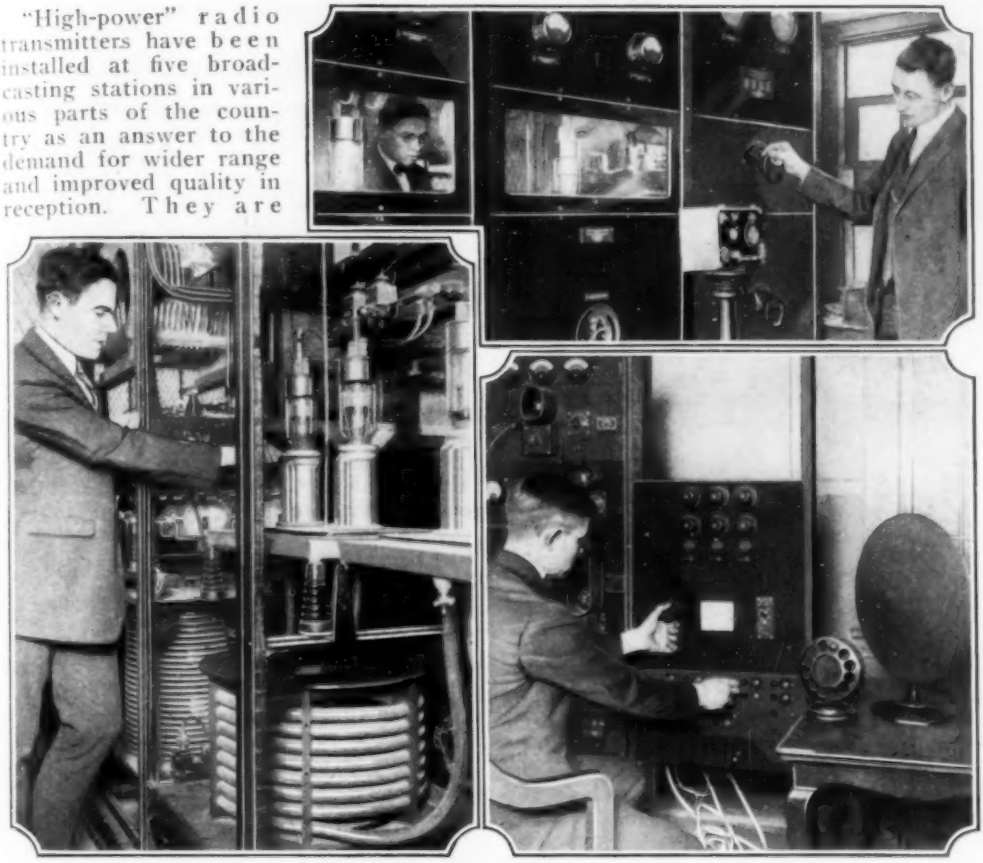
Amusement and healthful exercise are afforded children by a patented swinging board suspended on arms attached to stout posts anchored in concrete on the playground. From two to ten may ride at the same time, operating the board by alternately pushing and pulling on two side rails that extend the full length of the swing. An easy, gliding motion forward and backward results, giving somewhat the same sensation as that produced by a boat dipping over large waves.



Six or More Children Can Ride at Once on This Long, Rocking Swing Suspended between Steel Posts

WHAT "SUPER-POWER" MEANS IN BROADCASTING

"High-power" radio transmitters have been installed at five broadcasting stations in various parts of the country as an answer to the demand for wider range and improved quality in reception. They are



High-Power Transmitter at Station WCBD; Left, Power-Amplifying Tubes and Water-Cooling Coils; Above, Using Wave Meter at Tuning Unit and View of Control Board

5,000-watt sets, this measurement being on the basis of the amount of current that reaches the broadcasting antenna. But such a set delivers into the air only about 2,000 watts, or the practical equivalent of about three horsepower. The rest is lost, mainly through heat radiation. Hence a station with a set that may cost $60,000 or so, is delivering in usable form only about one-sixth of the power of a Ford engine. In other words, it would take more than six of these transmitting plants working together to deliver as much power into the air as is furnished by a "flivver" on the road. While the transmitter may be receiving 22,000 watts from the generators, most of this power slips away before it reaches the antenna for its journey through the air. Heat and other losses affect smaller sets as well, so that this limitation is not peculiar to the high-power station alone. It only shows in greater proportion.

Ship Gets More Speed on Less Fuel with Dummy Propeller

To overcome the loss of speed and fuel resulting from the churning set up by a ship's propeller, a fanlike device with fixed blades has been designed to increase the resistance of the swirling water. The vanes, by acting against the agitation of the water, cause it to present a more solid mass to the action of the turning screw, giving the propeller blades a stronger hold. In a test, the apparatus, which is located on the rudder post, is said to have caused a saving of one-sixth of the fuel usually required and an increase of ten per cent in the vessel's velocity.

Electric Cigar Sorter and Matcher Handles Four Thousand an Hour

Cigars are sorted at the rate of 4,000 an hour according to the color of their wrappers by an almost human electrical machine that is said to do the work of eight

Cigars Falling into Various Bins from Hopper as Sorter Detects Differences in Color

men and can handle thirty-two different grades at once. Its secret is the marvelous power of a photoelectric cell, such as is used by astronomers in determining the intensity of the light of stars and in some apparatus for sending photographs by wire. This cell generates electricity proportional to the strength of the light that strikes it. In the machine, it is adjusted to receive rays from four electric bulbs after they have been reflected from the wrappers of the cigars. Dark tobaccos absorb more light than do those of brighter shades, so that the amount of current generated in the cell varies according to the color of the cigar. An amplifying tube "boosts up" this current sufficiently to operate switches that cause the cigars to fall into different bins as they pass from a common hopper. The sorter is said to detect delicate differences in coloring that human experts would not notice at first glance. It is suggested that the principle of the device could be used in sorting bolts of cloth, button dyes and other products that are classified according to differences in color.

Decay in Stone Buildings

During an inspection of 200 stone buildings by the bureau of standards, it was found, in several cases, that the material had decayed, apparently from recrystallization of soluble substances which had leaked out over the surface or mortar and had been deposited on top of the stone or slightly beneath it. The expansion of the crystals, it was decided, had produced somewhat the same effect as frost, breaking off tiny particles. The same results were duplicated in a laboratory by partly immersing stone in a weak solution of sodium sulphate. The salt was absorbed through the pores and appeared again in crystalline form on the outside or within the samples. The decay was said to be most noticeable in sandstone buildings.

Memorial Shrine to Motherhood to Be Built at Capital

An elaborate memorial shrine in honor of motherhood is to be built in Washington, D. C. When completed the structure will cover a large plot of ground in a prominent section of the city, and will form an attractive addition to the great number of similar buildings that are visited each year by throngs of tourists passing through the capital. The cost of the shrine, which is sponsored by the Women's Universal Alliance, will be paid from a fund subscribed by people from all parts of the country. Accommodations will be provided in the building for both in and outdoor gatherings, and a speakers' stand will afford a clear view of the terraced steps.

Sculptor at Work on Miniature Model of Memorial Shrine to Motherhood, Which Is to Be Erected in the National Capital

How to Pick Your New Radio Set

By E. A. BEANE
Supervisor, Ninth Radio District

PICKING a new radio receiver, to build or to buy, involves other considerations than whether the cabinet matches the furniture and there are enough dials and knobs to satisfy a longing for experimentation in wireless.

E. A. Beane

Unless the prospective owner has decided first in his own mind what he wants the receiver to do, the chances of satisfying him are slim. One set will bring in the distant stations, while another features loud-speaker volume, and still a third is remarkable for the clarity of its tone. Some super-sets may combine all three, but the price will be correspondingly high.

Then, too, there is the question of where the set is to be used, the type of construction of the building, its location in reference to neighbors with regenerative receivers, its nearness to high-tension power lines, street-car trolley wires, elevated cars, electric-light power houses, doctors and dentists using X-ray equipment or violet-ray machines, and whether the building has electric elevator equipment. All these factors will influence the results, and should be considered in selecting the type of receiver to be used and its equipment. For example, most portable receivers and some of the non-portable sets are built with loop aerials, either incorporated in the equipment or connected to the exterior of the cabinet. But if you are going to use the receiver in a building with a steel frame, of reinforced-concrete construction or with metal lath in the wall, you can't expect to get extreme distance or much volume from the inside loop. The steel of the building and the metal lath of the walls act as a giant cage, absorbing a good part of the radio waves which otherwise should enter the room. The loop will work local stations under these conditions, but for distant stations an outside aerial is desirable.

An electric elevator in the building may cause an endless amount of annoyance, particularly if an inside aerial is being used. Every time a circuit is made or broken by the starting and stopping of the car, the fact may be recorded by unearthly howls, squeals and groans in the receiver. A high-tension power line, even though it may be many city blocks away, is a potential source of interference. Just the other day we began to receive a flood of complaints from a city district covering several square miles. Every radio owner in the section apparently called up to report that some amateur operator had gotten clear off his wave length and was sending code all over the dial. Each complainant reported the amateur was on a different wave length, ranging all the way from about 200 meters up to well over 500. When the reports persisted for two or

three days, we went out with a direction-finding set and started to run the trouble down. It was finally located on top of an electric-light company's pole! An insulator on the 33,000-volt line had broken down, and as the power surged over the gap to the ground, it sent out a wild jumble of dots and dashes which, to people who can't read wireless code, sounded like an amateur sending. Even the best receivers are not proof against that kind of interference, but they will get around much of the ordinary annoyances of

The Salesman May Be a Glib Talker When It Comes to "Low Loss" and "DX" but a Store Test Is Not Always Convincing

reception in the heart of a big city. On the basis of 100-per-cent perfection in reception the best set on the market may be said to be about eighty per cent efficient, the various other circuits grading down accordingly. These figures are only approximate. Variations of standard hookups and some trick circuits get results far above the average of their cost class—and then again some trick circuits rate well below the average of sets of corresponding cost.

If you want to get great distance, the first thing to consider is your location. In part of the ninth district—up in the Dakotas, for example—owners of two and three-tube receivers have no trouble in picking up stations from New York to Los Angeles, even in the daytime. On the other hand, in a big city like Chicago, where there are eight or ten powerful broadcasting stations, five or six-tube outfits may have trouble tuning out the local broadcasters to bring in the distant outfits. The city man who has to work through near-by local broadcasters and wants to get distance, should decide on a receiver with five or more tubes for best results, or else should be thoroughly convinced by demonstration that the set will tune out the local stations.

If volume is desired, the first thing to consider is the size of the room in which the receiver is to be operated. For a small room, the average city-apartment living room, for example, a two-tube set will give sufficient volume to operate a loud speaker on local stations. If the room is a large one, or has big archways connecting with adjoining rooms, three tubes should be the minimum on local stations for loud-speaker volume. One man who moved from a small apartment into another with much larger living room blamed his two-tube set because of decreased volume, and insisted it had gone bad. He bought new tubes and batteries, but still didn't get results. He had simply failed to consider the changed acoustic properties of his home. If both distance and volume are desired, nothing less than six tubes may be expected to give results. For the man who wants clarity of tone, and doesn't care particularly about great volume or extreme distance, a set em-

ploying resistance-coupled or impedance-coupled amplification, instead of transformers, is generally considered the best. A receiver of that type must employ at least four tubes. Much depends, however, on the loud speaker used. A set in which the tone was very "fuzzy" when employing a loud speaker with large horn, and which could not be improved by experimenting with the set, was corrected as soon as a loud speaker with smaller horn was put in use.

In any set built or bought to bring in distant stations, selectivity should always be considered. It is not enough to go into the store and see the clerk bring in a broadcast station 2,000 miles away. The question is, will the receiver pick up two distant stations on virtually the same wave length, separate them and bring in either with clear tone and without interference?

If You Build Your Own Set Use Only the Best Parts and, If It Is an Advertised Hookup Stick to the Parts and Diagram Recommended by the Designer

The best of sets, however, will not operate satisfactorily in the wrong surroundings, or with the wrong kind of aerial. I have an eleven-tube receiver which is as nearly perfect as any set I have ever seen. Its volume is not particularly great, but it will take any present broadcast frequency and reproduce with almost perfect tone, with perfect selectivity, and it gets the distance. I brought it down to my office, however, and could only get two local stations, one across the street and the other four blocks away! Two other local stations, not much more than a mile distant, could not be heard even on eleven tubes. That shows what building construction, elevated electric lines and street-car trolleys will do to a receiver.

Then, the nearness of neighbors with regenerative sets will affect any outfit. As long as this type of receiving set is permitted, or bought by radio fans, the trouble will continue. The bureau of standards found that an oscillating tube in a regenerative circuit could cause interference for a distance of nine miles around. I have seen an ordinary receiving tube used in a transmitter, and it worked from St. Louis to Savannah, Ga., a distance of around 500 miles. But take the bureau of standards' nine-mile figure as a conservative estimate and figure out how many regenerative sets are within that radius of your home, all of them being potential sources of annoyance. In a big city, 100,000 probably would be a conservative estimate.

The neighbor's regenerative set is responsible for most of the complaints we receive against various broadcasting stations. Calls come in that some local station has "broadened" its wave or is clear off its proper length and coming in at another place on the dial. Yet with 195 broadcasting stations in this district (besides 3,600 amateur operators) we have never found an authentic case of a wave length being broadened. Invariably the complaints may be traced down to a re-

generative set. Its owner tunes in on some near-by local station, and because of the volume of the broadcaster he detunes his receiver a bit, instead of regulating his tube voltage. The result is he is picking up the station several degrees off its natural wave length, and is rebroadcasting through his regenerative set, heterodyning the signals up to some other wave band. The effect is to "beat up," as we call it, the frequency of the sending station, until all the neighbors are picking it up, not on its normal wave length, but in the wave band to which the fellow with the regenerative set has heterodyned it.

When that happens the man who finds himself unable to tune what he thinks is an offending station out of the wave length of somebody else he wants to listen to, calls us up and either complains of wave-length broadening, or blames it on the broadcaster's harmonics. It is very easy to tell whether you are getting a harmonic wave, since they occupy fixed bands. Going down the dial the first harmonic is just one-half of the true wave length, the second one-half of the remainder, or one-quarter of the true wave, the next halves it again, making the third harmonic one-eighth of the wave, the fourth is one-sixteenth, and so on. There are no upper harmonics which can be picked up by any instrument yet made. All other waves you pick up off the wave length are the result of regenerative interference.

If you do buy or build a regenerative set, learn how to tune it sharply and to keep it from oscillating so you are not sending out false signals. And if a neighbor bothers you, perhaps you can pass your tuning information along.

A good part of all the troubles encountered in operating receiving sets may be traced to poor tuning. If the maker's directions are followed carefully, most of the trouble can be avoided. It may take weeks to learn all the peculiarities about any given receiver; one will give a distinctive click each time the tuning dials pass over a station, and another may indicate the same thing by a squeal or whistle, or possibly not at all. To get results you have to learn each of those distinctive quirks of your receiver. Lots of radio fans talk about turning the dial and having station after station pour in on the loud speaker. May be they do, but usually it takes patient tuning for each one.

There Is Nothing Like the Thrill That Comes When a Home-Built Set Is Connected Up and Brings in the Broadcast at the First Trial

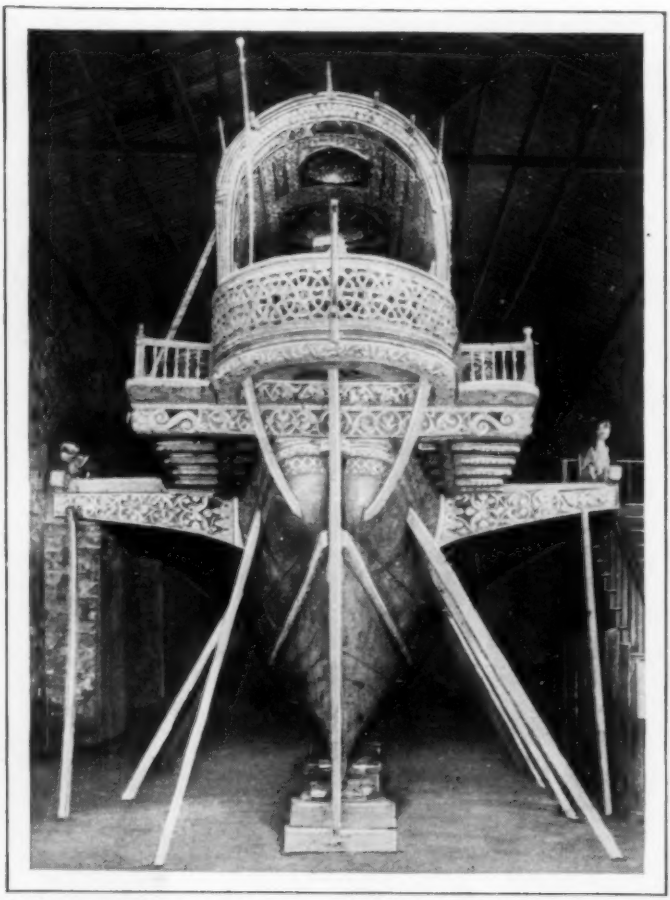
FIRST-AID STREET BOOTH HOLDS STRETCHER

Views of Emergency Station Where Help May Be Had in Case of Accidents Long Before Ambulances Arrive from Hospitals; Policemen Opening First-Aid Booth; Physician Inspecting Supplies and Folding Stretcher in Use

Conveniently placed near busy street intersections, public first-aid booths that contain a folding stretcher, bandages, medicines and other necessary equipment have been erected in Berlin to aid accident victims. Before an ambulance can reach the scene, this handy station may be called into service and perhaps lives saved by the timely use of the implements it provides. A public doctor of the city safety service regularly inspects the stock of supplies and the booth is at all times accessible to police or laymen when emergencies arise. Occupying but little space, it does not hinder traffic and can be moved easily and quickly.

Turtle Farm Earns Profit

What is said to be the only turtle farm in Iowa is located near Fertile, Worth county. The owner has built up a profitable business in supplying hotels and homes. The snappers are caught with nets or in traps during the summer and kept in underground stockades, being fed on minnows until they are sold in the winter months.



Ancient Royal Barge of Turkey Stored in Naval Drydock; the Vessel Is of Moorish Design and Requires 144 Oarsmen to Propel It

Ancient Royal Barge of Turkey Placed in Naval Drydock

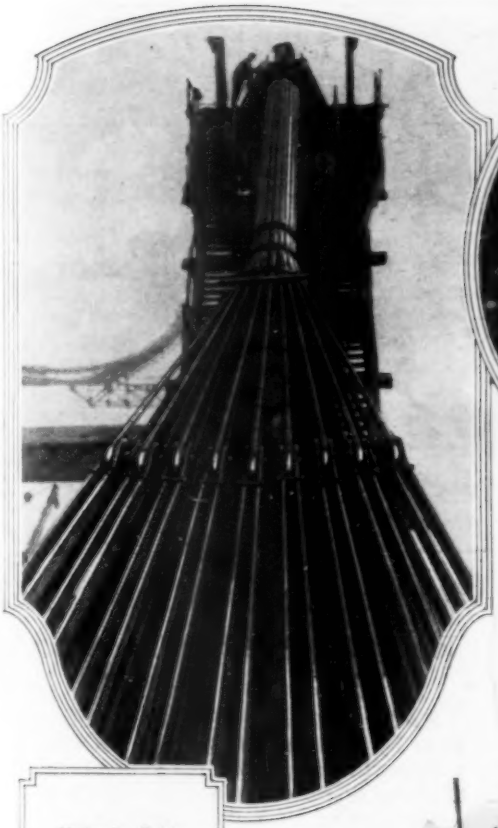
The royal barge of Turkey, built 280 years ago and used especially for the sultan and his family during imperial ceremonies, has been placed in the naval drydock. The boat, which requires a rowing crew of 144 oarsmen, is of Moorish design and is covered with elegantly carved woodwork. All the ornamental attachments were formed with hand tools by skilled craftsmen, who displayed their art in the construction of the deck canopy. The vessel weighs 110 tons and provides for a row of thirty-six double-banked oars on each side. The enormous beams were each manned by two rowers. The ship is built in the form of a caique, a type of light boat peculiar to the region of the strait of Bosporus, and such craft were once employed extensively for carrying passengers.

How Animals Take Their Naps

Various kinds of animals assume widely different postures when they sleep, and from their habits in slumber scientists are able to learn interesting facts concerning their nature. The dog, for instance, is said to curl around several times before lying down because that was its habit when it was a jungle animal, to form the grass into a comfortable cushion. Small monkeys of various kinds sleep on their perches with their fingers tightly closed as though holding on to branches. Giraffes lay their necks along their backs when they slumber. Horned animals, such as deer, keep their heads in the usual waking position and many horses do not lie down when asleep. Bears lapse into slumber in almost any posture, the sloth sleeps upside down hanging by all four feet from branches, and the anteater covers its body with its tail, while the bat takes a nap with only one claw to support it and its wings folded to make a light and waterproof tent over it. Creatures with short legs, such as the pig and the hippopotamus, for instance, lie on the side when sleeping.

Tons of Tallow-Dipped Steel Wire Bind Bridge to Concrete Base

One of the most vital units in the great Delaware river bridge between Philadelphia and Camden, N. J., is the pair of massive concrete anchors on either side to which the cables that support the structure are attached. Each contains about 75,000 cubic yards of material in which the long steel tie-rods that hold the separate strands are imbedded. In all, 25,000 miles of wire, weighing 7,100 tons, were used. Tar and tallow were smeared over each of the 18,666 individual wires in each of the two cables to prevent rust.



Units in Cable Fastened to Individual Supports and Then Joined as Single Huge Rope to Stretch across River

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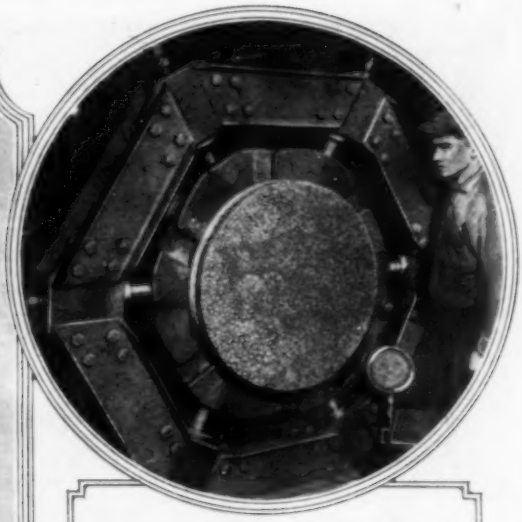
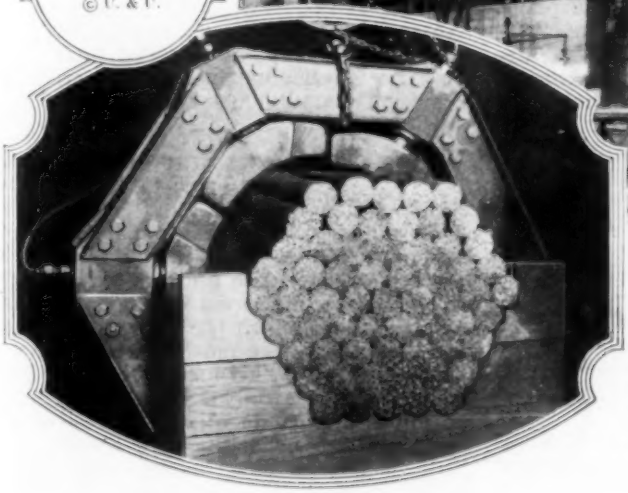
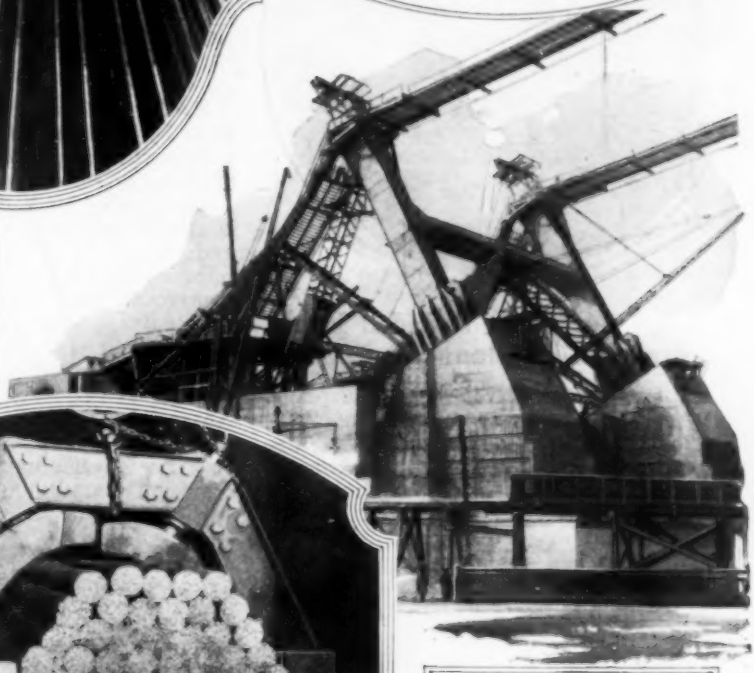


An End of United Mass of Wires Drawn Together in Powerful Press at the Anchorage





Left, Bundles of Separate Wires Ready to Be Squeezed; Above, View of Concrete Anchor Blocks and Steel Supports over Which Cables Are Stretched

Photo Above © U. & U.

Pigeons Taking Flight from Their Airplane Coop; Left, Opening Compartment Doors to Release Birds

Flying Pigeon Coop Carries Birds to Races in Belgium

Racing pigeons entered for flying contests by a group of Belgian fanciers are transported to the starting points in an airplane fitted up as a comfortable coop. Each team of birds is inclosed in a roomy compartment separate from the others, and on arrival at the destination, all are released at once. The pigeon house is constructed in the fuselage of the machine, with entrances on the sides, so that each cage is well ventilated, insuring the best of traveling conditions for the flyers. This method of carrying racing pigeons to be "tossed" is said to greatly benefit the little contestants. Several hundred birds can be carried, relieving them of the strain of crowded quarters on long overland trips.

Aviators Surveying Railroad Route Find Hidden Mountain Pass

A surveying party traveling by airplane over a proposed railway route in the province of Quebec, Can., discovered an unknown pass in the Abitibi mountains, which resulted in their changing the course of the line to a better and shorter one than that first measured. Although the road was laid out by a land group of surveyors, it is said the information gathered by the flyers will make possible a great reduction in operating costs of the completed system below the expenses estimated in the original plans. After the first survey was finished, the engineers decided to make a supplementary inspection of the route by air to check up the earlier charting.

¶Whenever you find that you wish to know more about any article in the magazine, write our Bureau of Information.

Young Mosquitoes Starved to Death by Poisoning Their Food

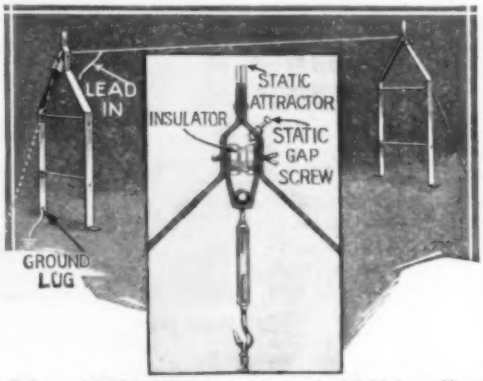
By putting chemical into ponds where mosquito larvæ are growing, scientists are reported to have found a way to destroy the minute forms of vegetable and animal life on which the "wrigglers" feed and thus starve the mosquito to death in its early stage. This method already has been used successfully in New Jersey. The poison is applied in quantities too small to injure fish or plants, and because so little is needed, its economy is an additional point in its favor.

Sahara Express Offers a Variety of Modes of Travel

The Sahara express run on regular twice-a-week schedule from Paris to Timbuktu in West Africa, includes travel by boat, automobile and tractor as well as rail. After crossing the Mediterranean by steamer, the journey, which takes twelve days, is by way of the Sahara desert where both wheeled automobiles and tread tractors compose the train to cover the hot, sandy wastes. This part of the trip requires three days, after which the travelers are taken in speedy motor cars as far as the Niger river, where the last stretch of 300 miles is made by boat. Hotels are established at the end of each day's stage and numerous stops are provided for rest. Among the hostelries are two old castles which have been furnished with bathrooms and other modern equipment for accommodation of the travelers. Since the route passes through wild country infested by bands of marauders, the trains are equipped with machine guns to repel attacks from hostile natives or tribesmen.

Aerial Supports of Metal Improve Reception and Aid Grounding

A practical support for antenna wires is now available, which may be used for supporting a single strand, or an aerial consisting of several wires. The support, which is strongly made of metal, offers a place to mount the lightning arrester where it is most effective. It is claimed to assist in the elimination of static by providing a direct uninterrupted path to the ground for this disturbing element, to aid in clearer reception, and permit greater distances to be covered. It eliminates the use of wood and nails, and does not detract from the appearance of the building. When mounted on frame buildings, the anchor screweyes on the end of the safety chains or braces are screwed firmly into the wood, and when used on brick buildings, the screweyes are provided with expansion shells which are placed firmly into holes drilled in the brickwork.



Substantial Metal Supports for the Aerial Make a Neat Job, and Are Easy to Install

Typewriter Balanced in Desk Is Easily Moved

A stenographers' desk with a top of the vanishing type has the elevating mechanism arranged to balance the weight of the typewriter so it can be raised or lowered with hardly any effort. Instead of the operator lifting the weight of the machine in opening the desk, the platform holding the typewriter glides smoothly into place as the top is swung back. With this counterbalanced design, injurious jarring and bumping are eliminated, and wear and tear both on desk and machine are reduced materially.

Typewriter Desk Which Balances Weight of Machine So It Can Be Raised or Lowered with Hardly Any Effort

Tobacco Is Tested with Mirrors to Detect Adulterations

Testing tobacco by means of mirrors is the plan an English expert follows to detect impurities. He uses a large glass or several smaller ones, and polishes them until not a trace of dirt or moisture is visible. The tobacco smoke is then blown upon the surface until it becomes clouded. If the moisture evaporates without leaving any mark on the glass, the condition of the tobacco is regarded as satisfactory.

Widespread Use of Radio Shown by Big and Little Tubes

Two extremes in radio tubes, a gigantic silica unit employed in a transmitting station and capable of taking a filament current up to fifty amperes, and one with a capacity of only a quarter of an ampere, were displayed at an optical exhibition in England, graphically illustrating what differences in equipment have become necessary through the widespread popularity of broadcasting. The larger tube is said to have cost nearly $750 and can take a filament voltage of thirty and a plate voltage of 12,000.

Extremes in Radio: Giant Silica Transmitter Tube and Small One Common in Receiver Sets

Science to Manufacture Blood?

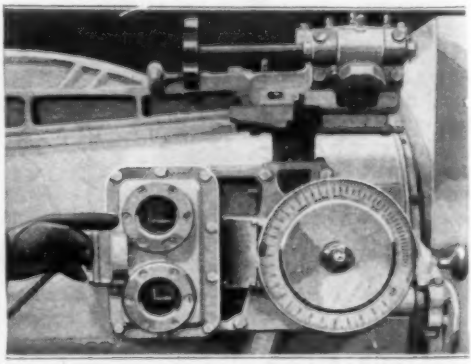
Man's supply of red corpuscles can be increased by application of a preparation made from spleen and bone marrow, according to Dr. Chauncey D. Leake, of the University of Wisconsin, who recently told the American Society for the Advancement of Science of successful experiments on rabbits, dogs and human beings. The experiments indicate the effect is due directly to stimulation of blood production, and to the fact that the combined spleen-and-marrow extract increases the resistance of the red-blood cells to destructive and weakening agencies within the body. Dr. H. G. Barbour, of the University of Louisville, at the same session gave scientific approval to the fiction writer's cherished phrase that "fear and terror curdled the blood in his veins." By applying a new method of measuring the thickness of the blood, he found that fear or excitement may cause the blood to become ten per cent more concentrated within ten minutes.

Wood-Saving Fluid Prevents Decay and Ends Blue-Stain Losses

Blue stain, which has caused heavy losses to the lumber industry, is being avoided by treating the wood with a chemical solution. This preparation comes in powder form, and dissolved in water, produces a solution in which the rough lumber is dipped. While it will not remove the stain if already formed, the fluid acts as a preservative. The liquid is colorless and will not mar the wood when it is dressed and cut into smaller sizes. Applied by brush to the exposed surfaces of lumber in completed structures, the solution reduces repair costs.

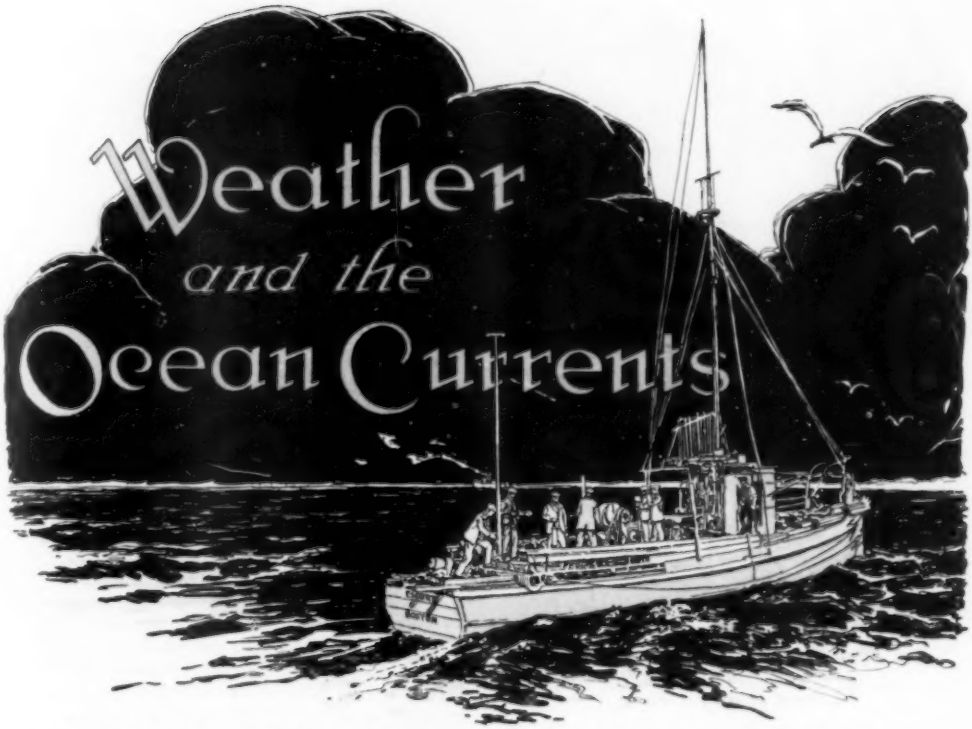
Submarine's Guns Guarded by Glass to Prevent Damage from Water

Strong shields of glass over the range and deflection gauges on the submarine's guns, protect the delicate parts from the action of the sea water when the boats submerge. Other parts exposed are made of rust-proof bronze. The entire deck equipment is arranged so that the submarine can descend on short notice without the need of removing the fittings or covering them with special protectors.



Hand Points to Glass Coverings That Protect Submarine's Guns from Water Damage

Weather and the Ocean Currents



Deep-Sea Exploring Launch Equipped to Make Ocean Currents and Their Influence on Weather Subjects of Scientific Study That Will Aid the Hydrographic Service in Perfecting Charts

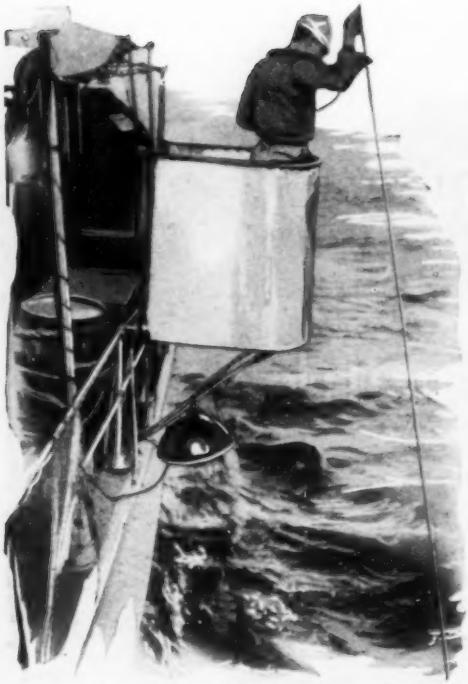
By S. R. WINTERS

MEASURE the amount of heat stored up in the oceans and you can forecast the conditions of the weather in 1927. That is the latest scientific theory to account for the freakish weather experienced during the past few years.

Herbert J. Browne, of the Smithsonian Institution, states that the weather for the next three years—1925 to 1927, inclusive—has already been determined by the heat stored in the ocean, which warmth was radiated from the sun during the years of 1921 to 1924. That is to say, the waters of the oceans are represented as a vast reservoir for receiving and distributing heat shed upon the earth by solar radiation. Observations made under the direction of Dr. C. G. Abbot, also of the Smithsonian Institution, indicate that the oceans distribute this heat to the earth in quantities varying from month to month and year to year. The waters of the oceans, however, act only as an intermediate reservoir for the storing of heat from the sun. Thus, it is reasoned, the full effect of a change in solar radiation is not felt until some years later. That is, the person who greets you on the street today with the exclamation, "Gee, what a cold morning!" may be sharing the effects of a sun that was none too generous with its radiation of heat two years ago.

For instance, the hydrographic office of the navy department received reports from mariners this last summer that the temperature and salinity of the waters in the Gulf of Mexico were reduced in comparison with former years. This is attributed to the fact that there was a lessening of the amount of radiation from the sun during the last two years. This slacking of the temperature conditions in the Gulf of Mexico, according to one theory, probably accounts for the enormous ice formations encountered in Iceland and Greenland by the aviators of the air service in their flight around the world.

"The rainfall of our southern states consists mostly of water from the Gulf of Mexico and the Caribbean sea," states Lieut. Comm. George E. Brandt, of the hydrographic office. "The evaporation of this water and its distribution in the form of rain depend upon the currents, the



Sounding Ocean Depths with Hand Line to Determine the Shape of the Sea Floor

temperatures and the salts of the surface waters of this region and upon the winds. Except for the winds, we know very little about these controlling things. Consequently, we cannot foretell what kind of weather we are going to have next year. When we know more about the oceans, we can calculate the elements of the climate cycle, and we will then have a means of predicting weather conditions a year in advance with certainty, particularly the periods of rainfall and drought and their duration. This information will enable us to control our agriculture and to take full advantage of those climate and weather conditions upon which the productivity of the soil absolutely depends."

Dr. George F. McEwen has succeeded in a measure, according to reports, in predicting rainfall in southern California from a study of the ocean temperatures of the preceding summer. However, the weather bureau is dubious about the possibility of long-range weather forecasting. "We are following George F. McEwen's forecasts in California with great interest and we have a high regard for Dr. McEwen's ability," comments Dr. W. J. Humphreys, of the weather bureau. "We want to see," he continues, "in most of these cases where predictions are made, a basis for the prediction. Long-range forecasts are given out every year in all parts of the world, and as a rule one is just a little bit worse than another, including those in the almanacs. They are based on nothing whatsoever, and when you follow them out, year after year, they go absolutely to pieces.

"We do want, however, scientific work such as McEwen is doing. He has ocean temperatures to a certain extent, but by no means as he or we would like them. No one has yet worked out the physical basis upon which a long-range forecast can be founded. Unless we have that basis there is little in such forecasts that intelligent men can place any faith in. As said before, we have the highest regard for Dr. McEwen. He is doing the right sort of thing."

The weather bureau, however, is committed to the expedition of the hydrographic office for the purpose of studying the beds of the ocean. "There is need for determining pretty accurately the surface temperature of the water," indicates Dr. Humphreys. "The present method of determining such temperatures is very crude. We would like to ascertain the temperature of the water down to a tenth of a degree. Small differences in temperature

Palmlike Plumes of Marine Plants Caught by the Camera as They Swayed in the Motion of the Water Several Fathoms Down

Operating Sonic Depth Finder Aboard the U. S. Hydrographic Surveying Vessel "Niagara," Whose Cruises Are Expected to Reveal the Relation between Sea Currents and Weather

frequently are very effective in determining high pressure and low pressure.

"One problem would be determining these temperatures to a high degree of accuracy. There are some places that are more important in this respect than others —the region between Washington and the Bermudas, or, in fact, from here across the Atlantic at latitude thirty degrees. The data on temperatures between here and the Bermudas are very important. We would like to know if there is a barometric high-pressure ridge. There is, in addition to these high-pressure ridges, a high-pressure peak at every place where one of these ridges is crossed by a cold ocean current.

"We would like also a survey of the output of ice in the Grand Banks region and we would like to know whether that ice is much more frequent in one year than another. We would like to send people up there and find out. Another thing we would like to know about is the supply of ice in the Indian ocean. One-half of the Antarctic continent is merely a great sheet of ice. Ten, twenty, thirty, forty square miles of ice will break off there and float away as a single berg. The amount of this floating ice varies in different years. It affects the temperature and the distribution of atmospheric pressure. The thing that seems most logical as the cause of one year differing from another in India is changes in ocean temperature, and that probably goes back to changes in quantity of ice that is broken off in the Antarctic.

"Another thing we would like to know is the difference between the direction of wind and ocean drift. If the winds push the ocean surface in a certain way and make the water drift on in a manner determined by the way the wind blows, the water must in turn react upon the atmosphere. So, also, must the land react upon the winds. We want definite determinations of the direction and velocity of the wind with increase of height. We want to develop a piece of apparatus whereby we will be able to know the direction and velocity of the wind at different heights Such an instrument can be devised. We find a curious thing commonly happens here in Washington and in most other places. As you go up, the velocity increases at first. Then you get to a place where the wind is faster than either above or below. Why is it faster, and at this particular place? I don't know. We want to know if that happens on the ocean in precisely the same way; if it has one law in one latitude and another law at another latitude.

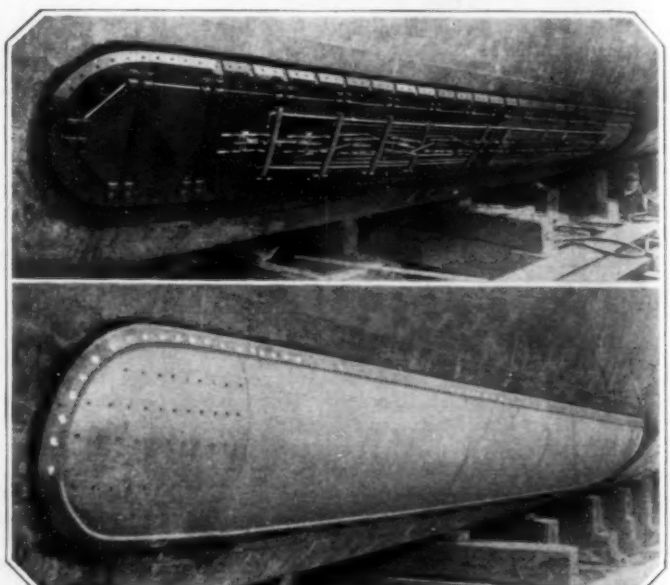
"Where and how does a tropical cyclone originate? We think we know

Reading the Log Which Registers the Ship's Speed by a Rotator Dragged Alongside

something about that, but we have never been there at the 'borning'."

In recognition of the need for a thorough knowledge of the ocean and its effect upon weather conditions, the navy department will begin an intensive study of the Gulf of Mexico next July. The expedition will study many subjects including the origin and habits of icebergs, the hot and cold currents, salt and gas in water, the plants and the animals that inhabit the sea, the winds and the waves, the fogs and the rains, radio communication and submarine cables, navigation and fisheries. In other words, the mysteries of the deep will be explored and an inventory of the resources of the ocean taken; Sir John Murray having expressed the belief that the total organic productivity of the earth's waters is probably considerably greater than the total productivity of its lands. That is to say, the vegetable and animal resources of the oceans greatly exceed those of the land. Five-sevenths of the earth's surface is covered with water and this vast body of waters teems with living organisms. This expedition, under the direction of Capt. F. B. Bassett and Lieut. Comm. George E. Brandt, of the hydrographic office, will further contribute to the wealth of information now available regarding our oceans. For instance, the amount of water in the oceans is 302,000,000 cubic miles, or thirteen times the volume of all the land above sea level. The average height above the level of the sea of the various land areas is about forty-four one-hundredths of a mile; the average depth of the sea is somewhat over two miles.

The scientific explorers will not only take into account the resources of the beds of the ocean—the mud, the fish, and other organisms—but the "how and why" of the Gulf Stream affecting the climate of our entire eastern seaboard will be considered. After completing the operations in the Gulf of Mexico, the expedition will explore the Caribbean regions and neighboring points of the north Atlantic, extending south through the Panama canal into the Pacific ocean to the Galapagos islands. Subsequently, activities will be extended to the north Pacific and north Atlantic oceans. "The climate of our Pacific coast depends directly on the ocean to the west" declares Austin Clark, of the Smithsonian Institution, "and responds at once to the changes in that ocean." The rainless summers of California, for instance, are due to such changes.



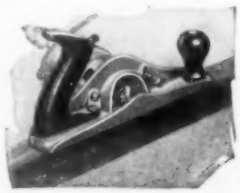
Sound Screen "Blister" on the Bottom of Surveying Vessel, for Sending Signals under Water; Showing Cover Removed and in Place

Rival of Glass Bounces Like Ball and Can Be Worked on Lathe

Although it has every appearance of glass, a material invented in Vienna is elastic and can be turned in a lathe. When a piece of the product is dropped on a solid floor it is said to bounce like a rubber ball. Only great strains will cause it to break, and it cannot splinter. The material will take a polish similar to that of glass and may be dyed or stained in the same way. Used as windows of vehicles, the substance may be of value in preventing injuries to passengers from shattered panes in case of wrecks. As a substitute for glass in toys, travelers' articles and roofs of hothouses, it would reduce the percentage of breakage. It is also said that in a thin solution it can be applied like varnish to pictures and furniture, allowing frequent washing without marring the surfaces, as it is not readily affected by acids or heat and cold. In the fluid form, the substance may be used for mending glass and porcelain and for stiffening cloth.

Weatherstrip Shaper Run by Motor Carves Molding on Window Sash

For grooving weatherstrip after it has been placed on window frames, a motor-driven shaper may be adjusted to cut to any depth or width to make the sash fit tight against the casing. By setting a threaded ring on the cutter, the tool can be fixed to make grooves at any distance from the edge of the strip, and a guide prevents the implement from being deflected from its path as it passes along the wood piece. The device may be readily carried about as needed, and power for its operation may be drawn from any electric-light socket.



Caboose Plays Leapfrog in Wreck Landing on Top of Coal Car

In a rear-end collision of two trains moving in the same direction, the caboose of the freight ahead was catapulted over one gondola car and landed on top of another loaded with coal, but little the worse for its queer game of leapfrog. How the wooden caboose escaped being crushed between the locomotive of the rear train and the steel car ahead of it, is one of the mysteries that sometimes characterize such accidents. Two men leaped to safety just as the crash occurred.

Pinched between Engine and Cars Ahead, This Caboose Kept on Going after Crash, Landing Safely on Loaded Coal Gondola

Ventilators Used as Water Intakes Help Replenish Steamer

Arriving at a wharfless port of one of the remote Aleutian islands, a steamer's crew was sent ashore with two dories to get water from a small stream to replenish the ship's tanks. When the small boats returned and were drawn alongside, the problem of emptying them, for a time, proved perplexing. It was finally solved by hoisting the dories and allowing the water to run out and into the tanks through the ship's ventilators.

Chinese Sailors Make Costumes to Put on Queer Play

Chinese sailors quartered in New York, after rescue from aboard a burning ship, staged one of their native plays for which they designed and made all the grotesque costumes for the actors. From material of various kinds

Grotesque Costume Designed by Chinese Sailors as Part of Properties They Used in a Native Play

available, they formed weird-looking masks, imitation dragons, and other fantastic garbs, some large enough to require two players to manipulate them. Several of the false heads were supposed to represent mythical monsters, and to add a touch of realism to the masks, movable jaws were attached so they could be worked by the player. Dragons' bodies were made from cloth and set in motion by a man within.

Imitation Porcelain and Marble Are Made from Feldspar

From an output of feldspar valued at $43,153 in 1914, the mining of that mineral in North Carolina, where one-third of this country's supply is produced, has developed into an industry turning out a volume estimated to be worth more than $360,000 a year. Although the gathering of the material in that state did not begin until 1911, the growing demand for imitations of valuable stone has resulted in great extensions to the workings. Used as both a base and glaze in the manufacture of pottery, chinaware, porcelain, and enameled brick and tile, feldspar is also the source of the glistening materials like marble and onyx seen as table tops, counter panels and soda fountains. Widespread employment of artistic stonework in interior decorations has also caused heavy drains on deposits of marble and similar naturally veined rock, but with the manufacture of feldspar into almost perfect imitations of these materials the heavy demand for the natural articles has been reduced. Feldspar abounds in many sections of the country and is easily mined.

War on Ants to Help Farmers of Tropics

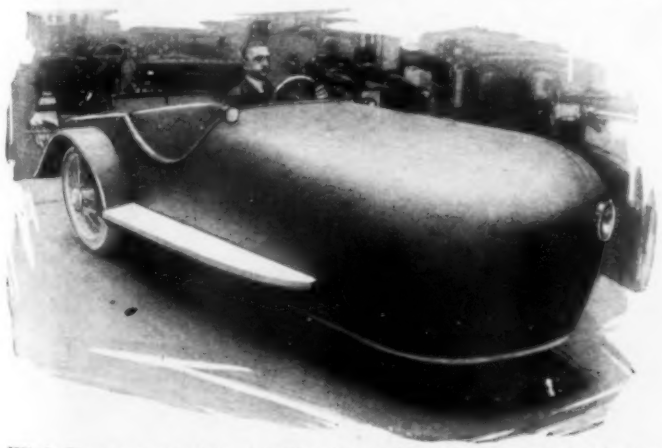
In an effort to combat the ravages of ants in tropical regions, scientists of the bureau of agriculture are studying various preparations for the extermination of the pests. The white ants, which travel in great armies, exist on wood and heavy roots and devour fence posts, house pinning and even totally destroy small buildings. Not only are structures attacked, but cultivated vegetation by the acre is consumed by the cutleaf or umbrella ants. These insects often clean out an entire garden in a night, leaving nothing but the bare stalks of the plants. In Colombia, where great colonies of these ants are found, they build large, cone-shaped mounds of a white claylike substance, which in many cases rise to a height of twenty feet and at a distance look like Indian tepees. Once started on a building, or piece of furniture, it is said the wood-eating species cannot be stopped by any method now known until the material is completely destroyed.

Radio Fog Signals So Successful That Service Is Extended

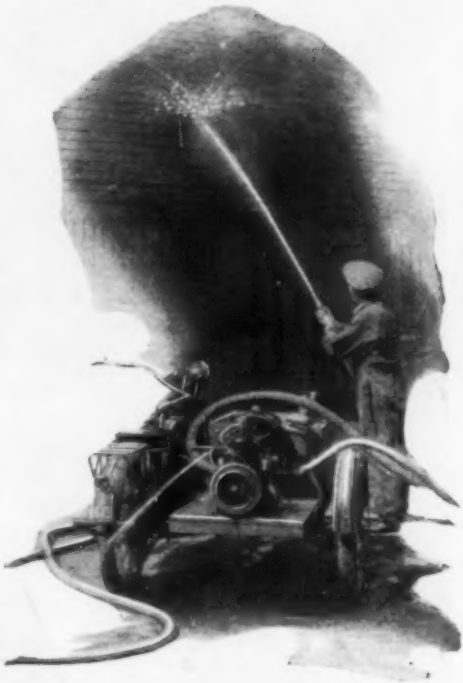
That the value of radio as an aid to navigation, especially as a protection against fog, the greatest of all dangers to shipping, has been further demonstrated during the past year and its use extended, is reported by the lighthouse service. Twelve fog-signal stations and three lightships have been equipped with wireless warning apparatus. Additions to these are being planned, and an increasing number of vessels are being fitted with radio compasses to take advantage of the safeguards. The total number of aids maintained by the lighthouse service is now 17,288. This is an increase of 395 for the year, and includes 120 automatic lights of which forty-eight were installed to replace attended beacons at old stations.

Automobiles Built in Queer Shapes to Save Weight and Space

Bodies of automobiles are being built in fantastic designs to accommodate developments of machinery parts and to give the cars artistic lines. One such model exhibited in Berlin consists of a sedan on which all corners have been eliminated producing a flat appearance when seen from a short distance. It is claimed this type is suitable for advertising purposes since a great amount of space is provided for signs and painted inscriptions. Another light-weight vehicle has been constructed with an enormous hood which causes the car to resemble a whale. Only three wheels are provided, a single one being under the forward part of the machine. Steering is done in the usual way.



Whale-Shaped Automobile of Light Weight Which Is Equipped with Only Three Wheels

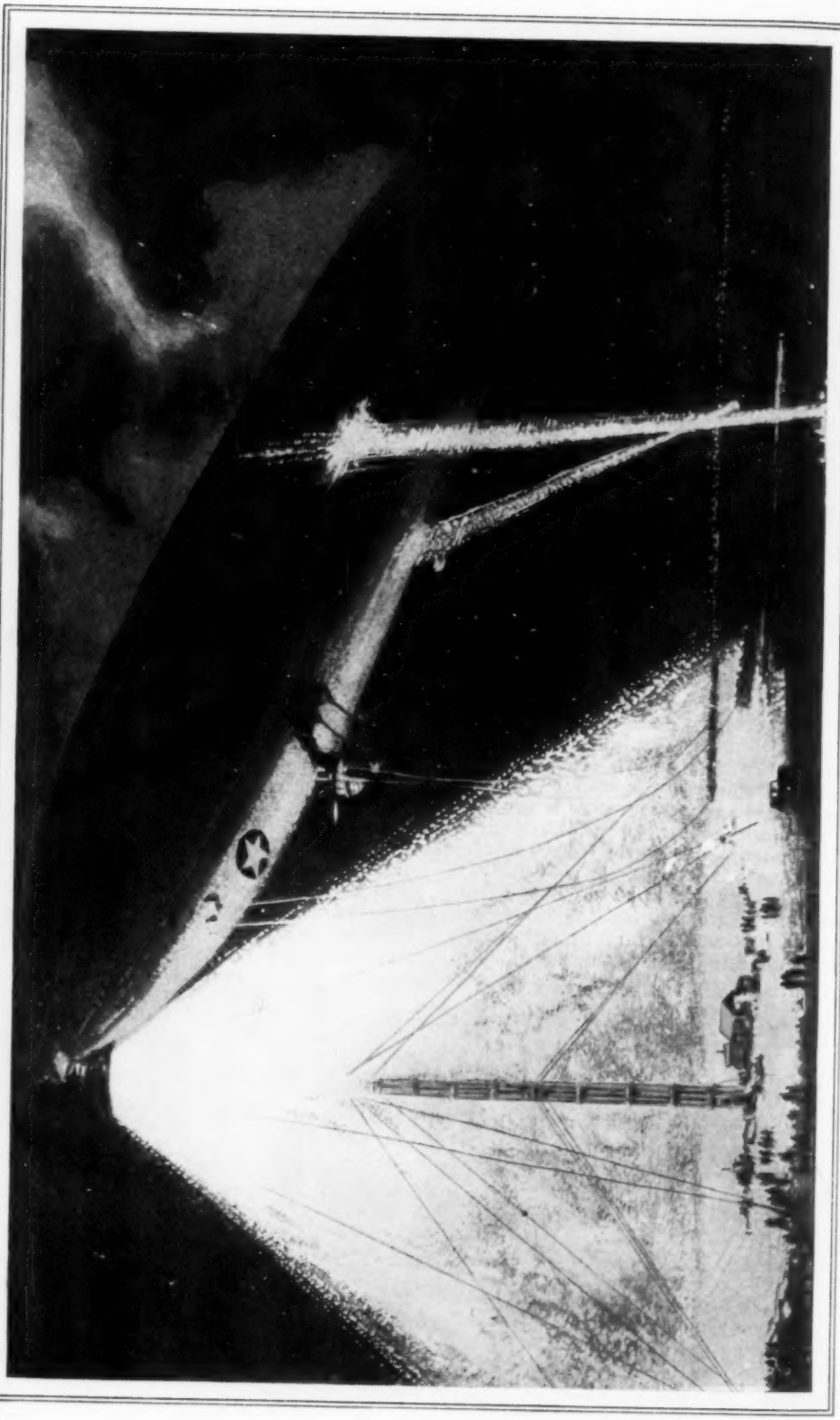


Motorcycle Fire Engine in Action during Test; It Also Carries Two Chemical Tanks

Motorcycles Fitted to Fight Fires for Protection of Forests

Promise of more effective protection of forests from fires is seen in a motorcycle outfit that carries a strong pump, hose, two chemical tanks, shovels, spades and axes stowed in a sidecar. Since these vehicles are capable of great speed and can traverse rough territory, they are able to reach spots inaccessible to other equipment. An extra man c- n be carried on a seat behind the rider, and there is a sufficient length of hose for reaching streams or other sources of water supply. These outfits are said to have given satisfactory results in actual forest-fire tests in California and are useful also on the farm.

¶The American flag that inspired Francis Scott Key to write "The Star-Spangled Banner," is in the Smithsonian Institution at Washington.



Banks of Brilliant Floodlights at the Top of the Landing Mast Throw the Ground Crew into Glaring Relief and Reflect Back along the Glistening Body as the Ship Sways under the Shifting Weight of Moving Crew and Supplies Being Stowed; Every Ounce of Human and Inanimate Weight Must Be Carefully Placed to Keep the Craft Level

794

From Drawing by Charles Owens

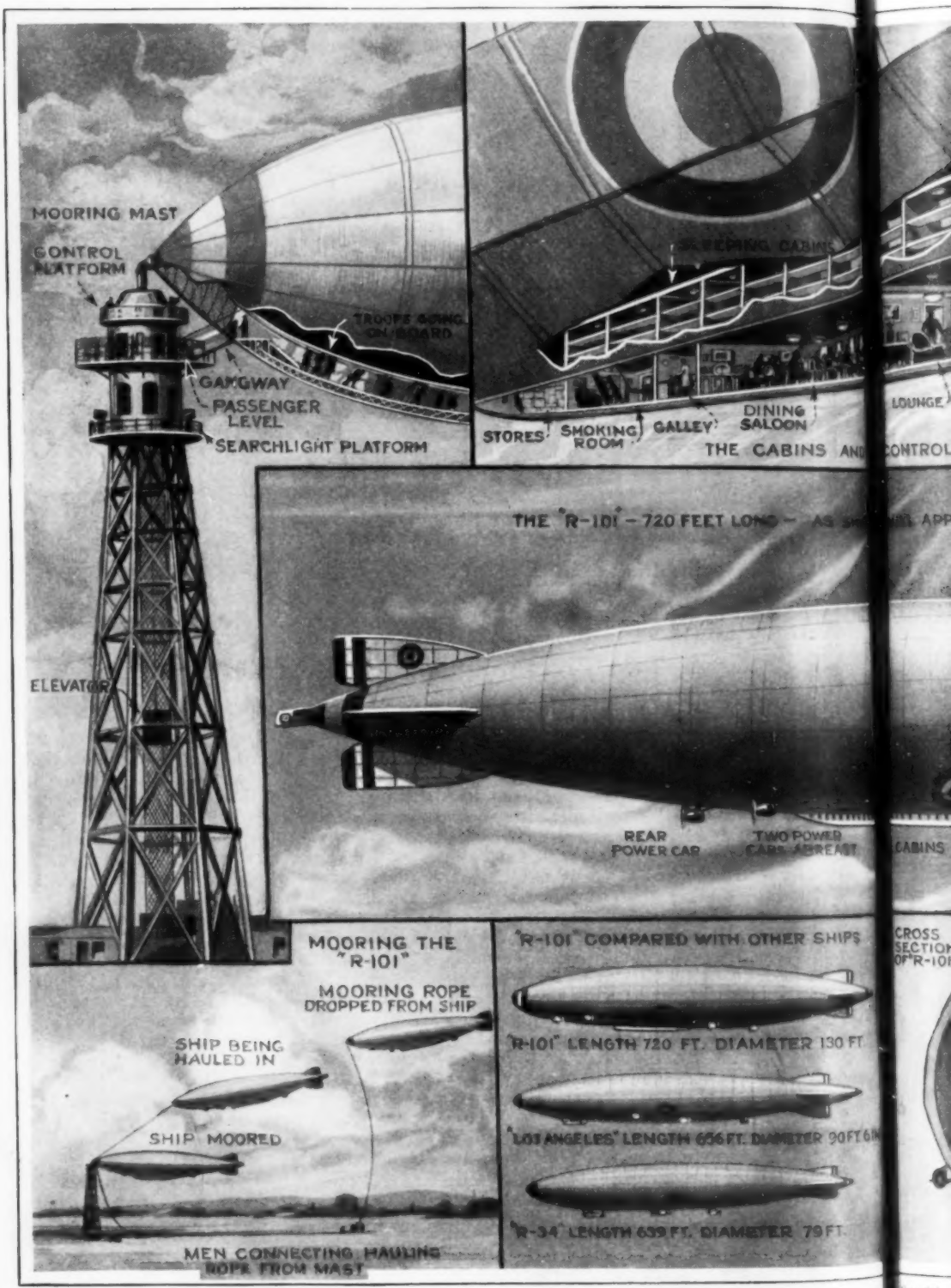
Akron Plant to Build One Super-Airship and British Government Two Five Million Cubic Foot Craft

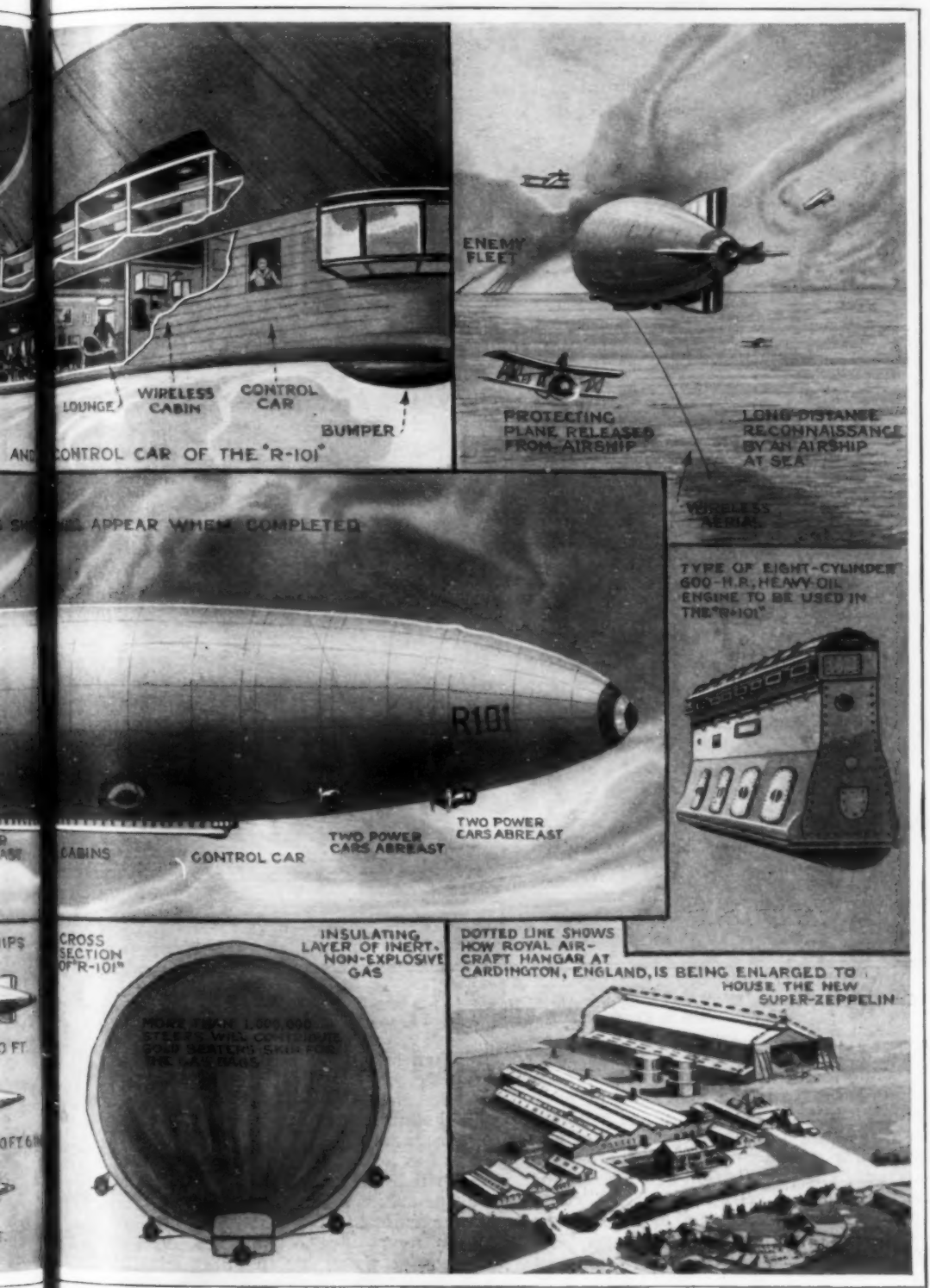
SPURRED on by the success of the "Shenandoah," "Daughter of the Stars," in her 9,000-mile flight around three sides of the United States and back, and the journey of the "Los Angeles" from Germany to the United States, both America and England are preparing to build lighter-than-air ships which will be twice as large as the present navy craft.

Airship building—before the war principally a German industry—appears to be coming into its own. The treaty of Versailles, which forbade further German construction with the exception of the "Los Angeles," built as a war reparation, has driven the Zeppelin constructors to other lands. An American company, owned jointly by the German Zeppelin interests and an Akron, Ohio, rubber manufacturer, are preparing to build commercial airships at Akron.

The English building program embodies several novel features. Zeppelin construction and use have been at a standstill in the British Isles for four years—since the ill-fated "R-38," built on order for the U. S. navy to be the "ZR-2," fell apart in mid-air, causing the death of her entire English and American crew. The "R-34," the old ship which was first to fly to America, has been lying idle and partly dismantled in her hangar ever since. With construction halted in England and Germany, and the United States the only builder, advancement in Zeppelin types practically stopped. The "Shenandoah," built at Lakehurst, was modeled after the plans of a Zeppelin which fell in the American area in France during the war. Except for being larger, she is in no wise much different from any of the war-time German ships. The "ZR-3," now the "Los Angeles," is the same type of Zeppelin, with the addition of passenger accommodations. She is the biggest practical airship ever built, but her gas capacity is a quarter of a million feet less than the ill-fated "R-38"

The new British ships, however, and the commercial craft being planned at Akron, will present several new developments. The Akron plans have not reached the stage of publicity, but the English designers have announced their program. To begin with, the two British ships will each have a capacity of 5,000,000 cubic feet of gas—twice the size of the two American navy craft. They will each be


MOORING MAST
CONTROL PLATFORM
TROOPS GOING ON BOARD
GANGWAY
PASSENGER LEVEL
SEARCHLIGHT PLATFORM
ELEVATOR
STORES
SMOKING ROOM
GALLEY
DINING SALOON
THE CABINS AND
LOUNGE
THE "R-101" – 720 FEET LONG –
REAR POWER CAR
TWO POWER CARS ABREAST
MOORING THE "R-101"
MOORING ROPE DROPPED FROM SHIP
SHIP BEING HAULED IN
SHIP MOORED
MEN CONNECTING HAULING ROPE FROM MAST
"R-101" COMPARED WITH OTHER SHIPS
"R-101" LENGTH 720 FT. DIAMETER 130 FT.
"LOS ANGELES" LENGTH 656 FT. DIAMETER 90 FT 6 IN.
"R-34" LENGTH 639 FT. DIAMETER 79 FT.


LOUNGE
WIRELESS CABIN
CONTROL CAR
BUMPER
CONTROL CAR OF THE "R-101"
ENEMY FLEET
PROTECTING PLANE RELEASED FROM AIRSHIP
LONG-DISTANCE RECONNAISSANCE BY AN AIRSHIP AT SEA
WIRELESS AERIAL
APPEAR WHEN COMPLETED
R101
CABINS
CONTROL CAR
TWO POWER CARS ABREAST
TWO POWER CARS ABREAST
TYPE OF EIGHT-CYLINDER 600-H.P., HEAVY-OIL ENGINE TO BE USED IN THE "R-101"
CROSS SECTION OF "R-101"
INSULATING LAYER OF INERT, NON-EXPLOSIVE GAS
DOTTED LINE SHOWS HOW ROYAL AIR-CRAFT HANGAR AT CARDINGTON, ENGLAND, IS BEING ENLARGED TO HOUSE THE NEW SUPER-ZEPPELIN

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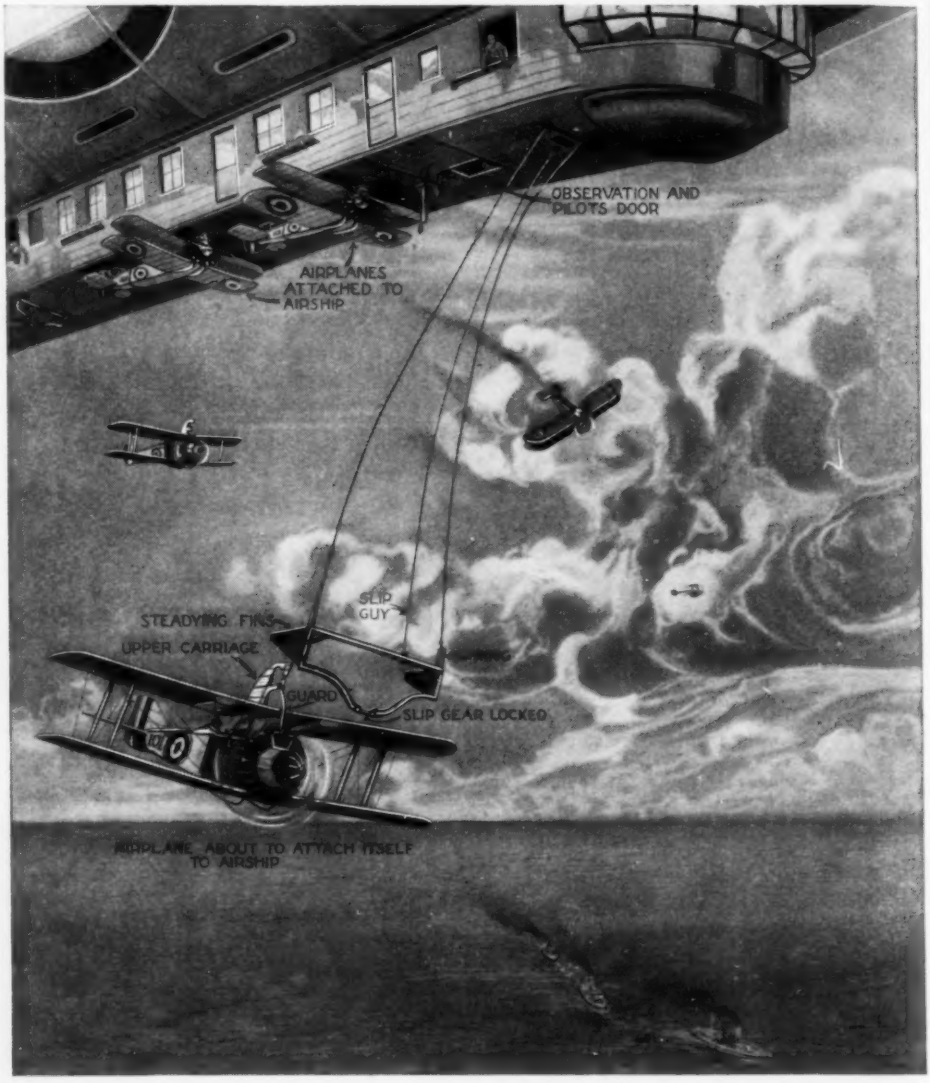

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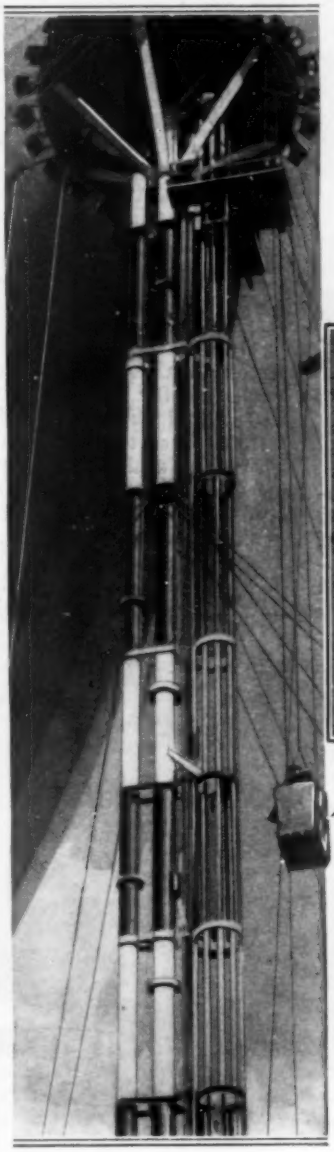
Several Airplanes Can Be Carried beneath Cabin of New British Airships and Detached or Hooked On at Will While in Flight, after Manner Developed by American Flyers

engined by seven motors, as compared to the American five, and, most radical development of all, the engines will burn kerosene instead of gasoline. Each motor will develop 600 horsepower, and will have eight cylinders. No magnetos will be used. The substitution of kerosene for the more dangerous gasoline is hailed in England as the greatest advance of all. In every case in which a Zeppelin has been destroyed by fire, investigation showed that it was the gasoline which caught first, and then set fire to the inflammable hydrogen gas.

The American navy ships, being filled with helium, of course, are not subject to the same fire danger. The United States has a monopoly on helium gas, but the British are planning to make their hydrogen ships safe, and at the same time give a greater lifting capacity than helium, by the novel idea of surrounding each hydrogen gas bag by an outer envelope containing either helium or some other

inert gas. The English ships will have a framework of stainless steel, instead of the duraluminum alloy used in the American craft, and will weigh about 150 tons, giving a "disposable" load, for passengers and cargo, of forty-four tons. They are being specially designed to operate at a profit in the London-India service, with accommodations for 200 passengers in peace time, or 100 soldiers and full equipment in war time. Provision is also made for converting them into hospital ships to transport wounded soldiers quickly to base hospitals. Their great size, with twice the gas capacity of the American navy ships, will not make them proportionately longer. In fact they will be but 720 feet long, as compared to the 656 feet of the "Los Angeles," and some 675 feet of the "Shenandoah." The increased gas capacity will be accounted for, however, by their diameter of 130 feet amidships, as compared to the ninety feet six inches of the "Los Angeles," and the still slimmer "Shenandoah." The greatly increased girth, however, is not expected to give much more head resistance, since the streamlines are still well proportioned. In the air the English airships will present an unusual appearance, since the pilot cabin and passenger accommodations, hitherto always carried in a car suspended near the nose of the ship, has been moved back, well amidships, and prolonged to many times the size of the cars on the American ships. The cabins will really be two-story houses, with the dining saloon, galley, lounge, smoking room, wireless shack and control cabin on the lower floor, with windows through which the passengers may watch the passing scenery, and the sleeping berths above, within the body of the ship. The English ships will be moored at 180-foot masts, equipped with electric passenger elevators. The success of the American mooring masts both on land and on the airship tender "Patoka," at sea, has assured their use, despite the fact the Germans never approved of them, and insisted on using hangars on all occasions. That an airship the size of the two American navy craft could be operated at a profit in commercial business is the contention of experts,



Giant Pipes to Pump Gasoline, Oil and Water Aboard, and the Swaying Basket Elevator for the Human Freight Are Features of the American Mooring Masts

and they point to the profitable business of the "Bodensee" in Germany, a ship much smaller than either of those now at Lakehurst. This claim is strengthened by the fact that the big new ships now being started, can earn a far greater proportionate profit, since the weight of a rigid airship increases approximately as the square of the linear dimensions, while the lifting power increases as the cube of those dimensions.

Slide Rule Holder with Rubber Pads Permits Use of Other Hand

The value of the slide rule as a time-saver in computing is said to be practically

Using Slide Rule and Holder with Only One Hand Leaves Other Free for Writing

doubled by a holder for the instrument that may be placed in any convenient position on the desk and has rubber pads on the bottom to keep it from slipping. With this device, one hand is left free for writing. Coil springs hold the rule in place.

More Men than Women Are Left-Handed

Men lead women in the tendency toward left-handedness, according to Prof. June E. Downey, of the University of Wyoming, who recently completed examination of 400 men and women. She found that those who could use either hand with equal ease were generally of superior intelligence. It was also discovered that, while fewer women were left-handed, there were also fewer women who were strongly right-handed; that people who place the left thumb over the right when folding the hands are inclined toward left-handedness, and that, for many individuals, the distinction between left and right is not nearly so well developed as that between up and down. In fact, many people have to rely upon some special mark to differentiate their hands.

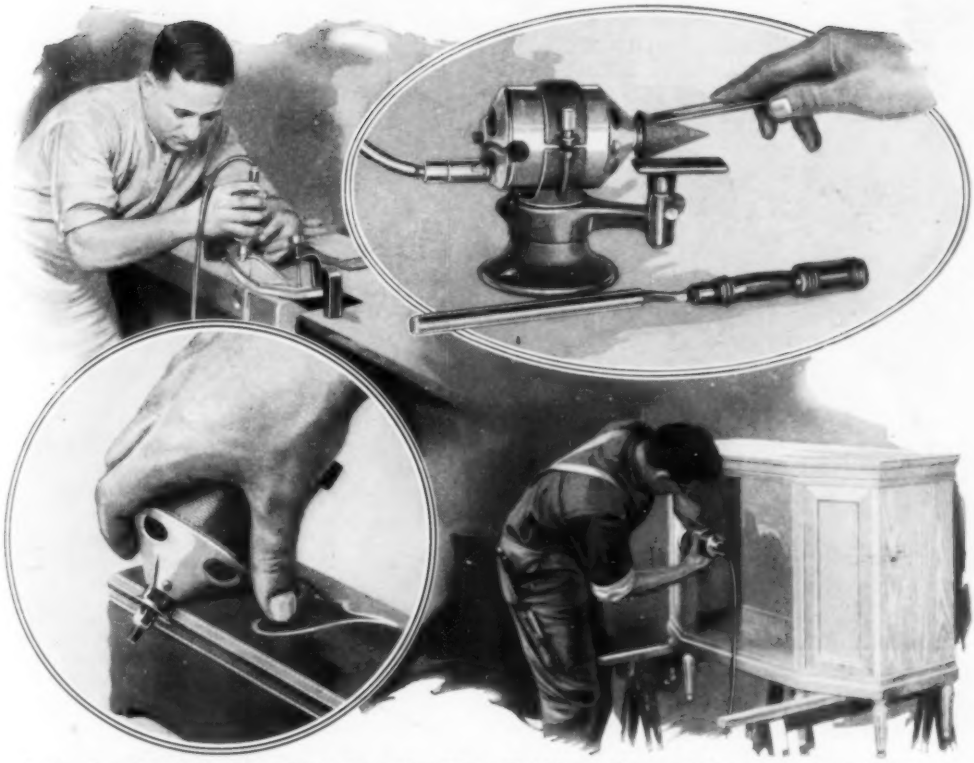
Rooting of Football Fans Measured in Effect on Grandstands

Added strains on the framework of a stadium caused by enthusiastic movements of the crowd were measured by the bureau of standards during a football game, in an effort to determine the best type of construction for the safety of such structures. When the audience was still, the strain on the steel frame showed an increase of about 1,000 pounds above normal conditions, but when the fans expressed their feelings by stamping or similar rapid motions an addition of 300 pounds was noted. The worst condition from the point of safety occurs when the crowd indulges in rhythmic stamping, which causes a strain exceeding the normal figure by 150 per cent. By means of these tests, it is expected valuable data may be gathered as a guide for future buildings devoted to large public gatherings, in the interest of safety.

Mattress Used as Life Preserver Is Worn Like Sleeping Bag

One of the crew of a Pacific liner has invented a combination mattress and life preserver for service in case of shipwreck. It is filled with a vegetable floss, chemically treated to make it waterproof, and is worn like a sleeping bag when it is to be used as a buoy. The arms are left free and ample leg movements are possible while wearing the device, so that a person can propel himself while lying flat and floating on the water. It is tied on with a few straps that can be adjusted quickly.

Bundled in Life-Preserver Mattress, Sailor Floats Safe and Dry Till Rescued



Cutting Out Material for Inlay Work, Smoothing Edges, Finishing Cabinets and Sharpening Tools with Emery Attachment, All Done Easily with Electric Shaper Operated with One Hand

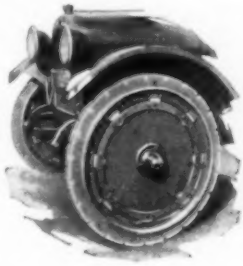
Electric Shaping Tool Fits Hand and Saves Woodworker's Time

Run by electric current supplied from a wall socket and easily guided by hand, a shaping and carving tool for woodworkers has a wide variety of uses and permits doing many tasks that otherwise would have to be assigned to more elaborate machinery. It consists of a one-eighth horsepower motor inclosed in a cooling chamber that does not get too hot for the touch. On the revolving chuck, a number of different kinds of cutting and carving attachments may be fixed, or a small emery wheel may be adjusted for sharpening. Finishing and decorating radio cabinets, making samples of furniture and applying inlay, line and two-tone work are but a few of the tasks the tool will accomplish. It weighs but a few pounds and requires little current.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

Flexible-Disk Auto-Truck Wheels Ease Bumps from Solid Tires

Disk wheels for auto trucks, that are said to permit the use of solid tires without sacrifice of comfort and afford saving through greatly increased mileage and less wear on the car, are now on the market. An outer felloe rests upon a series of eight coiled springs bolted to it and to the inner disk, thus making the wheel flexible and taking up shocks before they can reach the axle. At the ends of each spring is a fixed ball seat, adjusted in such a way that it responds both to uneven surfaces and to variations in the load. Test runs are reported to have shown that more than 50,000 miles can be obtained from a single pair of solid tires with this wheel, and that riding is as comfortable as with pneumatics.



Doll with Interchangeable Heads Is Whole "Family" in One

Dolls with heads that are screwed on or off and have costumes to match the different faces, have been devised to add to children's amusement and to develop their imagination and creative instinct. From three to twelve heads, and as many dresses representing a number of characters, can be obtained with each body. The dolls talk and walk, are unbreakable, and legs, arms and heads are made of a durable substance that is said to be proof against peeling or cracking.

Unscrew the Head, Put on Another, Change the Dress, and You Have Another Doll to Play With

Million Articles Lost Every Year on Railroad Trains

The number of forgotten articles left lying around railroad stations and in trains has become so great that special departments have been established for their care and disposal. The variety includes almost everything from books to live animals. One eastern system collected more than 10,000 pieces of lost property in a year from their suburban trains. Of these 4,115 were returned to the owners. In the collection were 1,200 umbrellas, 300 watches, 400 bunches of keys, and 600 rubber shoes. A total of $1,486.59 was found, of which $500 was the largest single amount. At the end of a twelve-month period all unclaimed matter is sold at auction. Among such a lot were an artificial arm, a cork leg, and a glass eye.

Movements of the Body Measured in Units of Heat

Ten per cent more energy is consumed by the average person in standing up than is required when lying down or sitting in a chair, according to Dr. F. G. Benedict, of the Carnegie institute, who measures heat units required for various motions of the body. The experiments showed that each change of position caused a corresponding rise in the energy output of the body. Some people, the scientist said, require as much as forty per cent more energy to stand than to lie. If a person in a reclining position raises the hand to the head and back, as in a military salute, one such movement each minute raises the heat output about one per cent. Working to the limit of endurance, a man may increase his normal heat output 1,000 per cent.

Auto Ambulance for Cats and Dogs Has Separate Cages for Patients

Treatment of sick and injured cats and dogs at an animal hospital in England is aided by a special ambulance that speeds to the owners' homes and carries the pets to the operating or examining rooms when occasion demands. The vehicle is an ordinary small motor delivery truck with the rear fitted up in individual compartments with separate doors and two larger outside doors that cover the tiers of cages.

Copyright, Underwood & Underwood

Removing Pets from Ambulance Compartments; Outer Doors Protect Them from Cold and Dust

Carving Furniture by Machinery

Multiple-Spindle Cutters Duplicate Finest Hand Workmanship on a Wholesale Scale

A REVIVAL of carved furniture has resulted from reduced costs following the invention and installation of automatic machinery to make decorative patterns, period designs and special combinations, many of which rival in finish and intricacy those made by hand.

These carvings are not wholly machine products for they are copied from a pattern that has been chiseled by hand, and each bit of decorative woodwork goes through at least two hand-finishing processes under skilled workmen before it leaves the shop. The machine's great contribution is in doing the bulk of the cutting and scraping, leaving the human carvers, who command from $1 an hour upward, to devote their entire time to the more delicate operations.

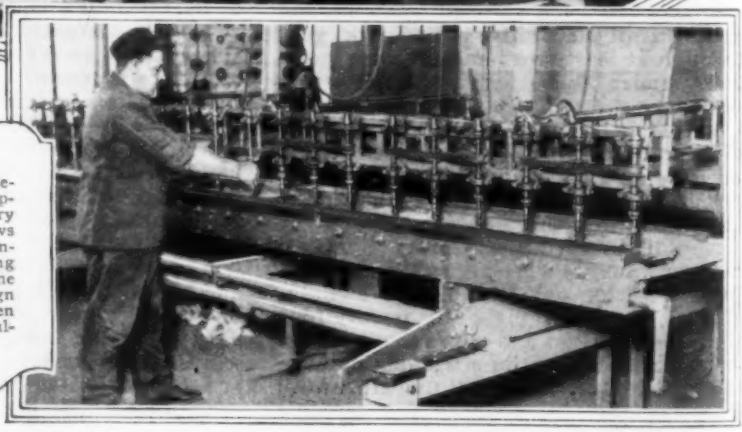
A modern furniture factory hums to the vibrations of what are called multiple-spindle cutters that duplicate simultaneously, in from eight to twenty-four pieces, every twist and curve that a workmen's chisel has left in a wooden pattern. With their daily output of upward of 600 pieces against the four or five possible with hand tools, the saving is apparent.

The twenty-four cutter, the latest development in furniture-carving machinery, consists mainly of a stationary table with a row of separate vises for holding and adjusting to any angle the wooden pieces that are to be carved. Suspended from the ceiling is a swinging frame called the "head." It is counterbalanced so that it can be moved about easily and holds a row of twenty-four bits, each fixed in a chuck.

These tools are grouped in sections of six each, and each section is run by a separate electric motor. The bits are set vertically and are whirled by belt drive at the rate of 6,000 to 10,000 revolutions per minute. The original pattern, made by a hand carver, is placed in the center of the table in a vise similar to that which holds the blanks. Just above it, is a short, blunt bar, attached to the swinging head like one of the bits. The operator grasps this and holds it against the pattern. As he moves it along the lines of the design, the entire head with its twenty-four whirling bits is moved and every curve and depression in the original is duplicated in each of the twenty-four pieces. The swinging frame is so carefully bal-

Hand Carver Preparing Piece as Pattern for Machines from Artist's Drawing

Sandpapering Edges after Carving



Views of Multiple-Spindle Carver with Operator Guiding Battery of Bits; as He Follows Pattern Block in Center, the Entire Swinging Head of the Machine Moves and the Design Is Traced on Eighteen or More Blocks Simultaneously

Courtesy Karpen Bros.

condition, else the pieces will be spoiled. pieces. When mahogany or other expen-

Alining the Pattern at Joints on Chair After Pieces Have Been Put Together, the Final Process in Hand-Carving Department

anced that deep cuts and light scrapings can be made at will. The bits are set alternately to cut in a right and left direction, for if all were rotated in the same way, the pull would drag the entire assembly out of the operator's hands and ruin the work.

Three principal kinds of bits are used. The first, known as a "rougher," is a double-bladed cutter that removes the bulk of the wood and traces the principal outlines of the design. Next comes the "smoother," a spoon or pod-shaped bit that takes off the rough edges left by the first tool, and last the "finisher," a sharp round instrument that brings out the relief and does as much of the finer work as can be done by a machine. All three tools are employed before the pieces are removed from the vises, as it would be impossible to reset them in the identical position they first occupied.

When the articles have received their machine carving, they go to the hand workers who prepare them for assembly. Rough edges are chiseled off, the relief is still further developed and sandpaper is used to wear down the marks left by the bits. There is but little machine carving today that does not receive extensive treatment from these workers. One more hand operation is needed before the piece leaves the department. When legs, arms and other parts have been assembled in the cabinet section, the design and figures of the different members are not in true alinement at the joints. Hand carvers therefore must true them up by an operation known as "trimming." When this is completed, the piece is finished so far as the carving department of the factory is concerned.

Many small articles can be carved without placing them in a multiple machine, and for this purpose the spindle cutter has been designed. It is like an emery wheel with a rapidly moving little steel bit in place of the grinder. The work is held in the hands, and the pattern is cut entirely without the aid of design marks by simply holding the wood under the bit and passing it in the required direction. These pieces can be turned out rapidly and with great accuracy.

One of the most ingenious machines in the furniture-carving department is a cutter that will make the exact reverse of the pattern. As the operator follows the lines of the original, say the left leg of a chair, for instance, a bit, set in a swinging arm at the side, reproduces the same design for the right leg, cutting it into the piece which has been clamped alongside the pattern. This one machine has saved furniture factories thousands of dollars and accounts for the perfect symmetry of the right and left members on various articles.

Hundreds of bits are required by the carvers and they must be kept in perfect

condition, else the pieces will be spoiled. Sharpening them and inspecting them is one of the most important jobs in the department. They must be fixed at exactly the same height in the machines and care is taken that each block of wood is set level. Operators of the cutters are said to acquire a subconscious skill which enables them to guide the spinning bits as delicately as they would a hand chisel. Their work is important, for a slip or a mistake in following the pattern may mean as many as twenty-four spoiled pieces. When mahogany or other expensive woods are used, this loss may reach a considerable sum.

Designing the pattern is done in another department where artists in wood originate novel combinations of scrolls and decorations and keep constant watch on the trend of public taste in matters of furniture. Their job has become increasingly difficult of late years, they say, for something new is in constant demand and there is a larger market for the better qualities of patterns.

Left, Operator Removing Finished Work from Multiple Carver; He Brushes the Fine Chips from the Depressions and Carefully Inspects Each Piece Before It Is Sent to the Finishers, Then Inserts Another Set of Blank Blocks, Turns an Electric Switch, and the Bits Buzz as They Bore into the Wood; Below, at Right, a Worker Is Using the Single-Spindle Carver on a Flat Piece; Work of This Sort Can Be Done Faster and More Cheaply with This Type of Carver as No Adjustments in Racks Are Necessary and the Designs Generally Are Simple; Different Kinds of Bits Are Inserted Quickly in the Shaft When Needed

Below, Completing Pattern from Which Dozens of Duplicates Will Be Made in Fraction of Time Spent on Original

Revolving Stands for Mail Boxes

Air Waves Like Those of Ocean

Paper-Lined Sacks to Ship Wool Save Sheep Growers Money

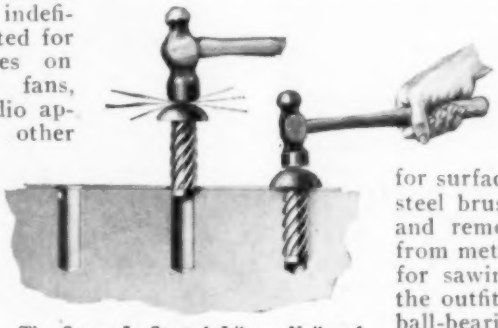
By the simple expedient of putting paper lining inside the jute-fiber sacks used for shipping wool, sheep growers in Australia are reported to effect an increase in value of approximately $3,000,000 of the annual clip. The paper keeps the sack fibers from becoming mixed in the wool. Formerly, the product had to be cleaned to remove the scraps before it could be sent to the spinning mills and the expense of the process was charged to the growers. The paper is of a thin, tissuelike quality and is placed in position after the sacks are in the presses ready to receive the fleece. Its use is said to be the invention of a young girl.

Color Photos at One Exposure

A German is reported to have invented a process for taking natural color photographs at one exposure. Three negatives, with red, yellow and blue filters and an arrangement of mirrors for reflecting the image, are used at the same time. In printing, the negatives, with their respective filters in front, are projected on a special paper, producing a naturally colored picture resembling a good three-color print. This saves taking three different exposures, and the method is said to be equally successful on portraits, interior views or landscapes.

Screws Driven into Metal like Nails to Save Time and Labor

Screws for all sorts of fastening work in metal which can be driven in like nails after a hole has been drilled, save the cost of tapping and are said to remain fast almost indefinitely. They are suited for permanent assemblies on machinery, motors, fans, vacuum cleaners, radio apparatus and many other purposes, displacing ordinary escutcheon pins, expansion nails and rivets. Threads on the screws cut and twist into the metal as they are driven in. They are furnished in plain steel or brass-plated and are made in a number of different sizes.



The Screw Is Started Like a Nail and Turns as It Goes Down

Portable Motor Concrete Finisher Cleans Stone and Removes Paint

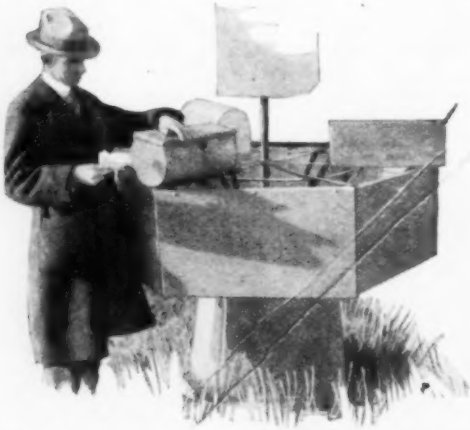
With a compact, motor-driven concrete surfacer and finisher that the workman

Smoothing Rough Concrete with Finisher Run by Motor with Cord Attachment at Worker's Waist

carries by means of broad shoulder straps, form marks and other irregularities are quickly removed or special finishes applied to cement. The entire apparatus weighs only thirty-two pounds and the tool itself ten pounds. It operates on direct or alternating current and has a capacity of from thirty-five to 100 square feet of surface an hour, depending upon the kind of work that is being done. The concrete is smoothed by means of a set of sixteen steel cutter wheels that revolve rapidly within a disk held in the hand. A grinding attachment is provided for working in coatings of cement and sand after the roughness has been removed. Other appliances, such as a cushion hammer for drilling, sander plates for surfacing small floor areas, steel brushes that clean stone and remove paint and rust from metal, and an attachment for sawing can be used with the outfit. Working parts are ball-bearing and are lubricated through a single grease cup. Operating cost, including current, it is said, will not average over two dollars a day.

Revolving Stands for Mail Boxes Save Postmen's Time

Strongly anchored to a concrete base, a revolving metal rack that will hold from one to a dozen mail boxes has been devised to save postmen time on rural routes. While seated in his delivery car, he can put mail into any one of the boxes simply by turning the frame. Inner braces on the sides of the rack form supports for the various letter holders and furnish convenient strips to which they may be riveted or otherwise attached.



Taking Mail from Box on Revolving Rack That Turns on a Strong Concrete Base

Paving the World's Streets

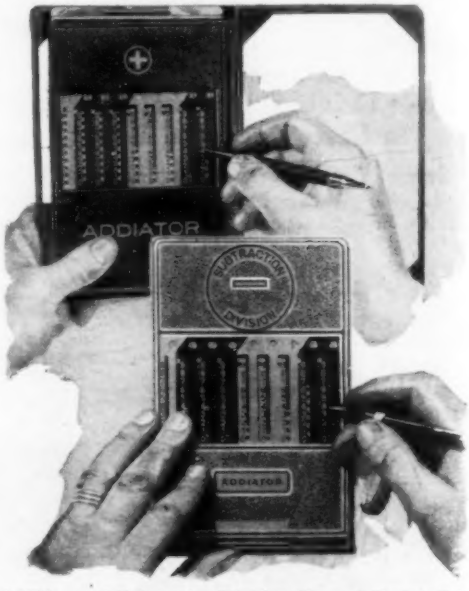
The lake of asphalt in Trinidad has fallen only fifteen feet since its discovery by early explorers, despite the fact that approximately 4,000,000 tons of road-making material have been removed. It is estimated that 10,000,000 tons of the mixture have been churned into asphalt by gases during the ages in Pitch Lake, which is known as Devil's Caldron among the natives. To transport the material, rails mounted on ties have been extended over the surface, and cars are run out to the diggers who never move the scene of operations, as each morning finds the holes left by the previous day's activity filled up. About every three days, the pitch covers the railway, which slowly sinks into the soft material and must be raised and relaid. By means of this track, 100,000 tons of asphalt are withdrawn from the lake each year. The entire deposit covers an area of about 110 acres, but its depth has never been measured.

Air Waves Like Those of Ocean But Hundreds of Times Larger

Just as the sea is constantly disturbed by crashing breakers, so the air is filled with waves, like those of the ocean, and caused, scientists declare, by currents blowing across quiet areas. These air waves, it is said, have crests and troughs and sometimes have dimensions 2,500 times greater than those of the sea, extending ten and twelve miles above the surface of the earth. Their movements are believed to partly explain the sudden gusts which occur in storms.

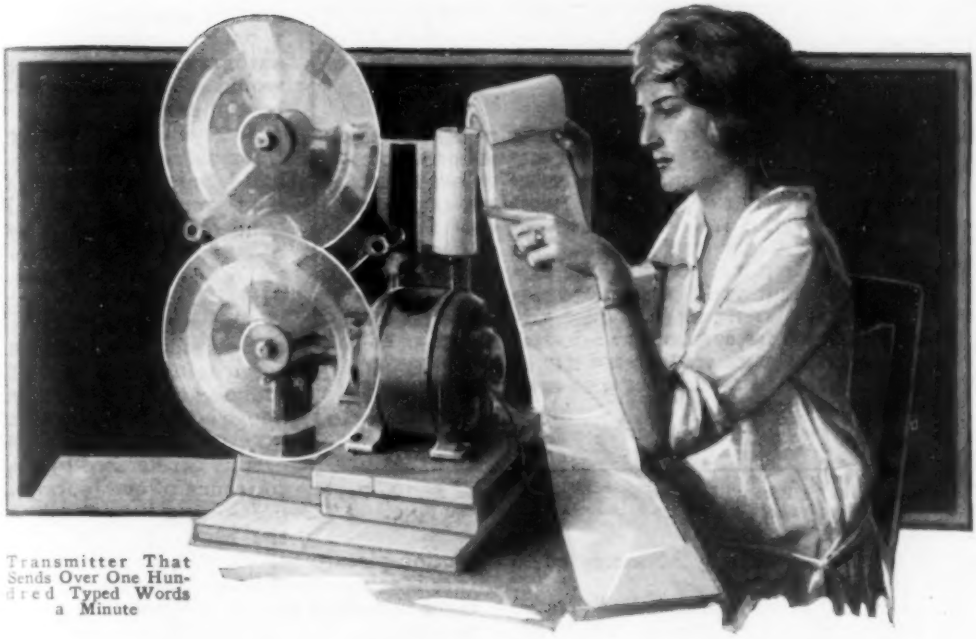
Double-Faced Pocket Calculator Adds, Subtracts and Divides

Compactly constructed as a flat pad that will fit the pocket, a timesaving calculating device that adds, subtracts and divides, has been placed on the market. One side is used for adding, the reverse for the other operations. Results are shown in a row of holes at the top of the digit columns, and the mechanism is moved by inserting a pointed stylus in the proper apertures on the card. The calculator is said to be absolutely accurate, does not easily get out of order, and besides working problems, registers errors the operator may make in moving the figures by showing red signals in the result column.



Addition and Subtraction-Division Sides of Pocket Calculator; Results Appear in Top Row of Holes

graphic impressions



Transmitter That Sends Over One Hundred Typed Words a Minute

Letters Sent through Space by Radio

Exact Duplicates of Hand and Typewritten Missives Are Transmitted at Rate of Hundred Words a Minute

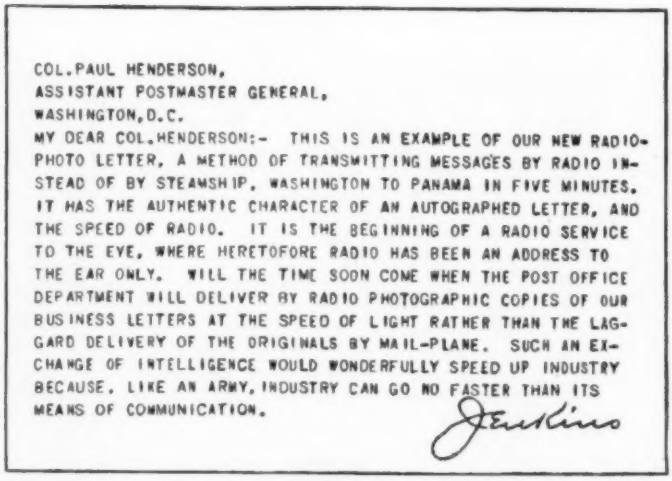
"DON'T write; send a telegram," the slogan of a telegraph company, may be modified in the future to read, "Don't write or telegraph; send your letters by radio." That is, letters written by means of a typewriter or pen and ink may be sent and received through space without intervening wires. This method of exchanging business communications is described as "the radio-photo letter."

C. Francis Jenkins, inventor of a radio motion-picture projecting machine, has devised an apparatus for the transmission and reception of written messages without resorting to the conventional way of communicating the written word, namely, the telegraph code. Instead of sending communications by means of dots, dashes, and spaces, common to telegraphy or radio telegraphy, photographic impressions of letters are sent and received, faithful to the manner in which they are written.

The radio-photo letter is one of the three lines of development in which Mr. Jenkins is primarily concerned; the other two being photographs by radio and radio vision. The three projects are closely related and the principles underlying their operations are so nearly identical that only slight modifications of instruments and equipment are necessary. However, the transmission and reception of both photographs and letters by radio are accomplished facts, while radio vision, or the ability to visualize distant objects and look on distant scenes, has not advanced beyond a laboratory experiment.

The principle of sending and receiving business letters by radio is not new; the novelty of the thing is in its application. That is, instead of a business man communicating by means of telephone or telegraph as formerly, he has a letter typewritten and transmitted at a speed of 186,300 miles a second. Not only is the message delivered with the speed of light, but the communication thus dispatched retains the authentic character of an autographed letter. For instance, handwriting or signatures to typewritten letters are faithfully transmitted and received; there is no doubt as to the authenticity of a communication thus transmitted. Radio-photo letters are sent at a rate of 100 words per minute, although it is antici-

Oak Common Lightning Target — Inkless Printing Press Turns Out



COL. PAUL HENDERSON,
ASSISTANT POSTMASTER GENERAL,
WASHINGTON, D.C.
MY DEAR COL. HENDERSON:- THIS IS AN EXAMPLE OF OUR NEW RADIO-PHOTO LETTER, A METHOD OF TRANSMITTING MESSAGES BY RADIO INSTEAD OF BY STEAMSHIP. WASHINGTON TO PANAMA IN FIVE MINUTES. IT HAS THE AUTHENTIC CHARACTER OF AN AUTOGRAPHED LETTER, AND THE SPEED OF RADIO. IT IS THE BEGINNING OF A RADIO SERVICE TO THE EYE, WHERE HERETOFORE RADIO HAS BEEN AN ADDRESS TO THE EAR ONLY. WILL THE TIME SOON COME WHEN THE POST OFFICE DEPARTMENT WILL DELIVER BY RADIO PHOTOGRAPHIC COPIES OF OUR BUSINESS LETTERS AT THE SPEED OF LIGHT RATHER THAN THE LAGGARD DELIVERY OF THE ORIGINALS BY MAIL-PLANE. SUCH AN EXCHANGE OF INTELLIGENCE WOULD WONDERFULLY SPEED UP INDUSTRY BECAUSE, LIKE AN ARMY, INDUSTRY CAN GO NO FASTER THAN ITS MEANS OF COMMUNICATION.

Jenkins

Sample of Letter as Sent by Radio with Original Signature Exactly Reproduced, an Advantage over Dots and Dashes

pated that the speed may be increased to 1,000 words a minute.

"Radio messages in facsimile," stated Mr. Jenkins in an interview, "of handwriting, signature, and explanatory sketches not only can be sent in speed competition with the dot-and-dash telegraph, but they have unusual tactical value to the army and navy, for this is the only method of radio communication which may carry its own authentification by the addition of the autographic signature of the sender."

The mechanical means of transmitting and receiving business letters by radio is that of the so-called cylinder method. The operation depends upon the rotation of two cylinders. The apparatus is not new. In fact, Mr. Jenkins picturesquely claims that the mechanical parts were recovered from his "museum" and that they are at least fifteen years old. Modern technique has been applied to this old machinery, and as a result a combination device for both sending and receiving letters by radio has been produced and placed for commercial use. The cylinder method also has been employed by the American Telephone and Telegraph company for the transmission of pictures by wire and radio, one unit being used for sending and another for receiving.

Business letters by radio, according to Mr. Jenkins, would speed up commerce, and yet such communications would be none the less authentic and binding. These same letters, because of their photographic accuracy and autographic authenticity, would be admissible as evidence in court. In time of war, these photographic impressions would constitute an autographed order and would command obedience thereto.

Mr. Jenkins, in the transmission of pictures and letters by radio, does not require a special band of wave lengths, as now allocated to other radio services. "Incidentally," he explains, "may I suggest that there are possibilities in radio service in the almost unlimited frequencies above audibility, in which speed transmission is greatly accelerated by the tolerance of eyesight, not possible in an appeal to the ear? Witness the motion-picture screen upon which a picture is taken off and put back again forty-eight times per second without annoyance to the eye; while the slightest error in a note in the orchestra is detected at once and grates harshly on the ear.

"We don't particularly need any special frequency band, nor does the use of our devices in any particular way interfere with other stations. Radio engineers have been working in the very limited audio-frequency band, a range of relatively few cycles, somewhat comparable to the old long-wave limitation, whereas the workable range where light instead of sound is employed goes up to millions of cycles. I confidently predict that the next great development will be in this area. Incidentally, there is this advantage also, in the use of light instead of sound, the bite of the 'static' is not fatal."

World's Climate Has Not Changed

That the world's climate has remained practically the same for centuries and will not change noticeably for ages to come, is the opinion of James H. Carr, official forecaster of the United States weather bureau in New York. As proof of his assertion, he cites the redwood trees in California some of which are 4,000 years old. They could not have attained their great age had climatic conditions altered to any great extent, he believes. There are weather changes over periods of years and variations in the climate but, in general, it is regarded as a steady procedure with no more real differences than exist in other natural phenomena.

Prize Cabbage at Fat-Stock Show

produce the desired result. Old wolves

Oak Common Lightning Target Because of Deep Roots

Studies in western Europe are reported to have shown that the oak tree is more frequently struck by lightning than other varieties. This is believed due to the deep root system of the oaks, and because they grow in loam and sandy earth—better conductors of electricity than clay. Their height and starchy content constitute an additional danger to them. Elm, ash, poplar and gum trees have also been found rather susceptible to damage, while the chestnut, maple, cedar, alder and mountain ash are less attractive to lightning. The department of agriculture has recommended that valuable trees be protected with rods.

Telephone Booth with Lattice Legs Affords Ample Ventilation

City telephone booths now being installed in Gothenburg, Sweden, for street service, have only the upper part inclosed, leaving the lower portion open except for a lattice screen on three sides. This is said to give adequate ventilation without interfering with the use of the instrument, and shuts off noises that sometimes make it difficult for talker and listener in ordinary street phones. The occupant stands on a raised platform above the pavement.

Plenty of Fresh Air Always Reaches This Telephone Booth through Lattice Openings Below

Inkless Printing Press Turns Out Complete Typewritten Letters

While printing imitation typewritten letters, an automatic press fills in each

Feeding Address "Slugs" into Automatic and Inkless Printing Press Which Produces Typewritten Letters Ready for Mailing

sheet with the individual name and address to which the circular is to go. All of the type matter may be produced on an ordinary typesetting machine. After the body of the letter is locked on the form, the address "slugs" are deposited in a tray from where they are automatically fed into contact with the printing ribbon, and are removed to a storage chute. No rollers, inking pads, or other similar attachments are necessary on the machine. Manned by two operators the press can turn out 2,400 matched letters in an hour, eliminating the labor of a number of typists who would be necessary to fill in the sheets with addresses.

Railway Bridge Planked for Autos Serves during Washout

When floods swept away both road bridges over the Van Duzen river in California, auto traffic was spared a long delay by putting planks over a railway bridge near by and using it as a crossing during the emergency. Gates were placed at the approaches and watchmen stationed to warn of trains. Semaphore signals were installed some distance back of the bridge for the guidance of engineers.

Prize Cabbage at Fat-Stock Show Covers Platform of Scales

Judges at a fat-stock show in England had difficulty in weighing a huge cabbage

© U. & U.

Its Broad Leaves Overflowing Platform Scales. This Prize Cabbage Proved Difficult to Weigh

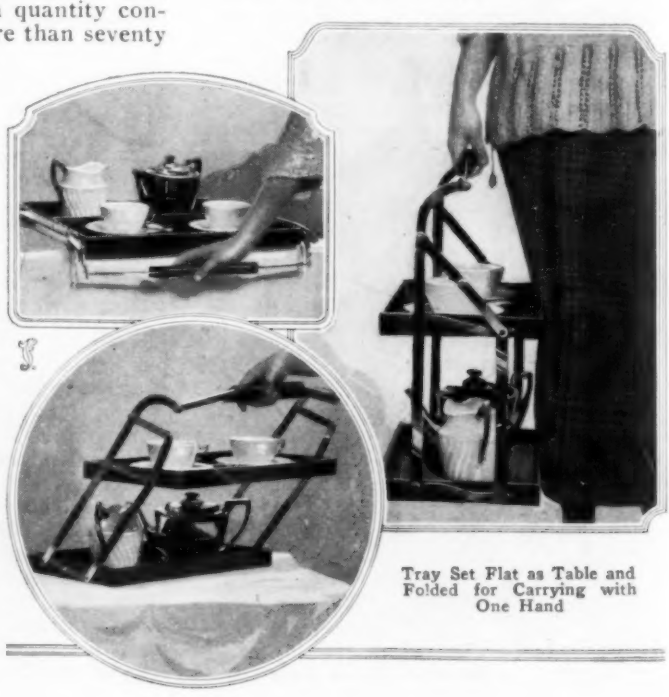
entered with the exhibits, as its leaves spread over the platform of the scales and rested on the floor. These vegetables, while comparatively low in food value, rank next to the potato in quantity consumption per year and more than seventy varieties are known and cultivated. Some species attain a height of ten feet and the stalks are used for canes. The common garden cabbage is more than ninety-seven per cent water.

No Quarter Is Given in War on Wolves

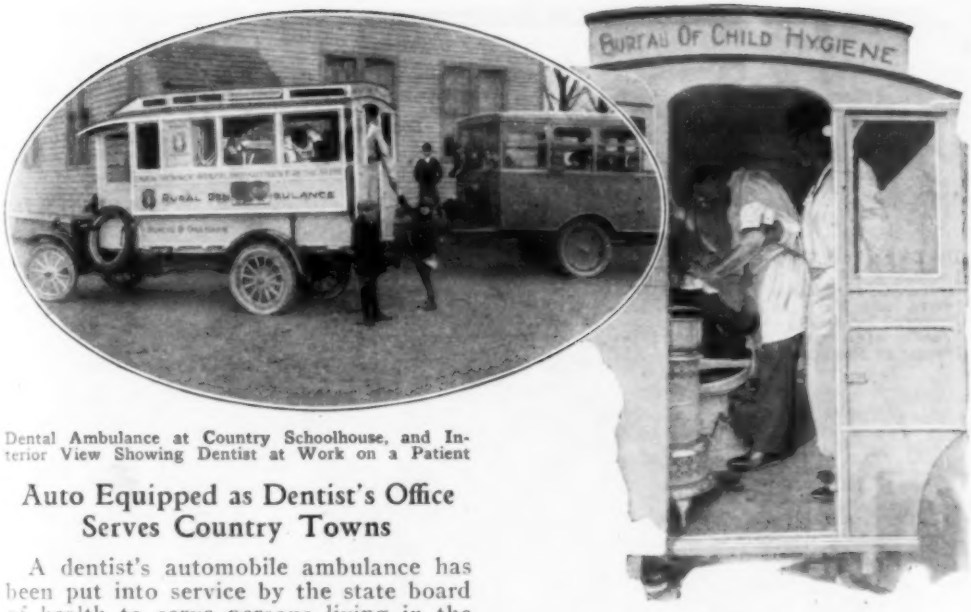
Wolves, in spite of the long fight waged against them by county, state and national governments, are still a source of worry and loss to ranchers whose live stock they destroy or menace. For ten years the government has sought their elimination. Bounties, ranging from $2 to $10 a piece, have been offered for the scalps, but even this has failed to produce the desired result. Old wolves seem to grow "wise to" the tactics of the hunters and avoid traps and poisoned baits no matter how carefully the lures are concealed or disguised, but many young ones are killed by these methods. Naturally accustomed to run in packs, individual animals, growing bolder, travel alone. One such beast took heavy toll from cattle herds in Colorado for a long time until finally caught by an ingenious trap set by a government hunter. Another lone wolf slaughtered sheep and cattle to the value of $25,000 before poisoned bait ended its foraging. This animal was followed nightly by a pack of coyotes, which fed generously on the remains of the carcasses left by the killer.

Folding Tray Carried with One Hand Saves Labor and Breakage

Much of the work and hazard of carrying breakfast or tea dishes on an ordinary tray is eliminated with the use of a double-section holder that lies flat on the table and folds into an upper and lower shelf arrangement with a handle for easy lifting. One hand is left free for opening doors when this article is employed, it is so compact that it allows free passage through narrow places and there is little danger of the dishes slipping off.



Tray Set Flat as Table and Folded for Carrying with One Hand



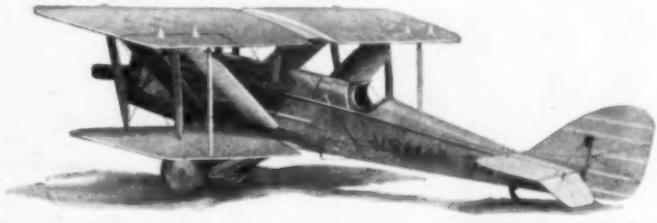
Dental Ambulance at Country Schoolhouse, and Interior View Showing Dentist at Work on a Patient

Auto Equipped as Dentist's Office Serves Country Towns

A dentist's automobile ambulance has been put into service by the state board of health to serve persons living in the outlying sections of New Jersey. It is fitted with a chair and a complete set of implements for almost all kinds of work on the mouth. Wide windows afford better illumination than is to be found in the ordinary office. A dentist and attendant accompany the traveling clinic, visiting country schools where examinations are made of the children's teeth. Lectures are also given to the crowds that usually gather as soon as the ambulance halts.

Latest Air-Mail Plane Is Safer, Faster and Cuts Costs

Marked reduction in carrying costs and increased speed for delivery of Uncle Sam's air mail are promised in a plane submitted to the post-office department after having been flown 100,000 miles in test flights. It is said to be capable of bearing seven times the load now allotted to the craft, reducing cost of mail transportation from $2.63 per ton-mile to about thirty-five cents, and can maintain a speed of 130 miles an hour as against 100, the present average. These results are reported to be due chiefly to changes made in the wing equipment. In addition to the regular two broad ones, four wings have been placed between them, two on each side and at an angle. They are said to function after the manner of parachutes, permitting low speeds when landing, giving greater gliding distances should the motor fail and preventing nose dives and tail spins during flights.



At First Sight, This Plane Looks like Others, but There Are Four Steadying Wings between the Two Big Ones

Bank Deposit Chutes in Outer Wall to Foil Safe Robbers

For the convenience of firms that may have deposits to make after closing hours and to spare them the risk of keeping large sums in office safes overnight, a Texas bank has installed a system of steel chutes that extend through the outer wall and are reached from the street. Each customer is given a key to the chute he rents. The bag containing the day's receipts, or other valuables, slides down a passage too small to admit a person into a steel compartment inside the bank building and is duly recorded the next day.

for Woman's Workshop in Home

Time and Money-Saving Tools

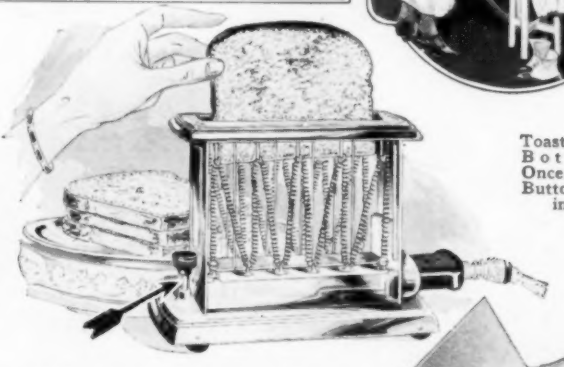
By Turning Top Crosspiece on This Opener, Can Itself Revolves, and Top Is Removed by Steel Wheel without Danger to Fingers

By Thrusting This Corer Part Way into the Apple, the Center Is Removed, Forming a Cup for Sugar in Baking

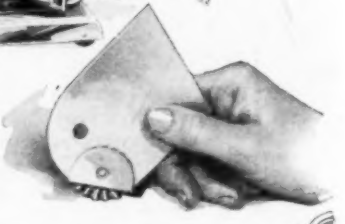
Clamp for Lifting Stack of Hot Plates Will Not Release Them Until Laid Down

For Homes without Plumbing, Folding Bathroom with Oil Water Heater and Decorative Screen, Inclosing It When Not in Use, Provides Comfort and Convenience

Simple and Durable Hat for House or Garden Wear



Toaster Browns Both Sides at Once and Has Button for Lifting Slice



Several Kitchen Tasks Are Done with Handy Little Tool at Right, Such as Scraping Pans and Bread Boards with Broad Edge, Cutting Cakes and Cookies, or Marking Pies and Fluting the Edges to Make the Juice Stay In, with Little Wheel at Corner; It Can Be Hung on Nail through Hole at Side and Lasts Indefinitely

814

Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

Left, Plant and Flower Label That Keeps Name from Weather in Transparent Top

Beater with Handy Holder and Crimped Dasher for Fast Work

Rocker Seat for the Baby Is on Wide Disk Base So It Cannot Tip Over and Affords Healthful Exercise for Infant Learning to Walk

By Turning Knob, Stamps, Bearing Words or Marks the Buyer May Select, Are Moved into Place

This Wrench Fits All Sizes of Tops, Won't Slip, Gives Powerful Leverage and Spares the Hands

Left, Handy Sifter for Flour or Other Materials That Rests upon Dish or May Be Attached Permanently to Table; the Protecting Plate at Right Is a Double Air Chamber to Equalize the Heat, Keeping Liquids or Food from Boiling Over When Using a Gas Flame, or May Be Used as a Toaster or for Heating Flatiron

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

815

Traffic Police Dummy at Crossing Warns Autoists to Go Slowly

With his star and uniform, a traffic policeman on duty generally inspires caution in many motorists who might disregard or fail to see other warning signs. Practical use of this fact has been made at a dangerous railroad crossing in a Pacific coast city by installing a dummy figure of a policeman near the roadside. It can be seen at some distance, is made more impressive by the addition of a large replica of a star on the coat and the sign "Go Slow" printed on a flag the figure appears to be holding.

Motorists Usually Slow Down When They See This Dummy Policeman on Duty at Railroad Crossings

Camp Schoolhouse Built on Wheels Is Moved by Locomotive

Where the tall fir timber grows in western Oregon, schoolhouses have been built on wheels so that they may be moved whenever the logging camp advances farther into the forests. A small locomotive is hitched on and, without greatly disturbing classes, moves the building, children and all, to the next site. Drinking water from springs near by is piped directly into the room, and other conveniences are provided at each stop. Five of these classrooms on wheels are in use, and the county school superintendent reports that they are successful in every way.

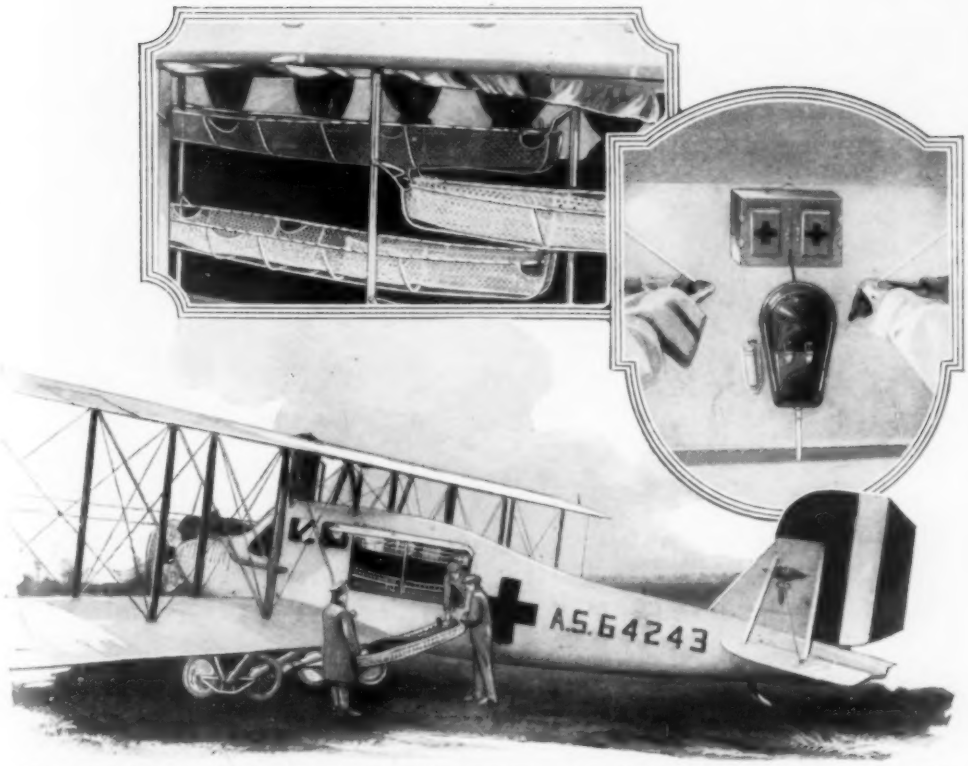
Hay Rids Harbor Water of Oil Scum When Scattered over Surface

Hay cast on the surface of the harbor waters of Stockton, Calif., removed a thick coating of black oil and grease left by leakage from boats and refuse pipes. Each day a small quantity of the material was scattered in the current and gradually absorbed all the scum as well as 400 gallons of fuel oil which had flowed into the basin from a burst storage tank. The tide washed each day's supply of hay to one end of the channel, and there it was raked from the water and burned. Although a month's time was estimated to be necessary to complete the task, almost all of the oil was removed in a week.

Stain-Removal Chart Quickly Tells How to Clean Fabrics

A revolving disk chart that shows what kinds of chemicals to use on different goods and for different stains has been devised for the convenience of housewives. On the outer edge of the upper half of the card are printed the names of the commoner qualities of cloth and on the revolving circle are listed sixteen stains most frequently encountered. By turning the card, the names may be made to coincide according to the particular case that is to be remedied. Toward the center of the disk will be found numbers referring to the chemicals to use, which are listed with directions at the bottom.

Chart That Shows What Stain Removers to Use on Different Kinds of Fabric



Three Stretcher Cots as Carried in Fuselage Compartment; View of Medicine Chest and Folding Basin between Beds, and Loading of Airplane Ambulance at Field

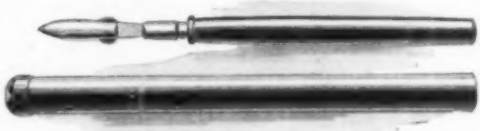
Airplane Ambulances in Army Use Can Land at Low Speed

Efforts of the army air service to develop practical airplane ambulances have been rewarded by marked improvements in facilities for handling patients and in designing machines that can land at speeds less than thirty miles an hour, a great advantage in restricted areas. In a plane of recent type, the surgeon or attendant can sit between two specially designed litters, and by the use of levers, may move either patient about to permit a thorough examination of injuries, adjust bandages or administer medicines. Another craft can carry eight or more patients at once. The planes have been found of special use in emergency cases of all kinds at places difficult to reach by motors or trains. In addition to the desirable feature of their speed, the aerial ambulances ride so smoothly that persons suffering from fractures generally arrive in better condition than when carried in other ways.

¶ Watches were not successfully manufactured by machinery until 1840.

Fountain Pen Made for Draftsmen Produces Coarse or Fine Lines

Fountain pens for draftsmen are now being supplied by an eastern firm which declares that its product uses India ink without clogging or blotting and that the point and feed are so adjusted that coarse or fine lines may be drawn as with an ordinary pen. An automatic principle has been adapted, which is said to regulate the flow of the ink to suit the breadth of the line. Hard rubber and brass are the only materials used and these substances, it is claimed, tend to prevent drying and



Fountain Drawing Pen Closed and Open, to Show Point and Barrel Container

clogging of the ink in the fountain. The accessory is carried in the pocket as an ordinary fountain pen.

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Under Expert Teachers in Trade Schools Where Lessons Mean Actual Work with Real Materials, Skilled Laborers Graduate into Contractors and Apprentices Become Finished Craftsmen

Opportunities in the Building Trades

Technical Training Is Not Essential, While Willingness to "Rough It" at the Start Pays Well in the End

By L. H. G. BOUSCAREN

MOST of us feel the fascination of the construction business at a very early age. The boy who builds mud dams in the gutter of a city street after a summer's rain, feels this fascination. After a sufficient number of his dams have washed out, he begins to realize that there is something wrong with his methods or materials. About that time lad No. 2 arrives with a suggestion that the next dam be provided with a non-washable spillway, built of brick taken from a neighbor's brick pile. The experiment is tried with improved results. Lad No. 1 has made the important discovery of the value of engineering advice. The construction business as it is now carried on by the great construction firms in this country, offers an unlimited scope to our ambition to build things. I say "as it is now carried on" and "in this country," because construction as we do it now is entirely different from what it used to be in this country, and from what it still is abroad. I can illustrate this from personal experiences. My own

Courtesy of the Landis Award Committee

Miniature Indoor House Put Up by Building Students

Apprentices in Plumbing Class Learning Finer Points of the Trade Together with Theories of Economizing in Materials; Below, Brick Masons of the Future Running Up a Wall under Direction of Instructors

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Modern House Erected in Record Time by Trades Apprentices in Vocation School Where They Get Outside Experience

father was a civil engineer of national reputation. I remember that when I was a small boy going to school he was chief engineer for the construction of the Cincinnati waterworks. That was a $10,000,000 job. It was thoroughly well done, and stands now as a monument to his engineering and administrative skill. But it took him ten years to do it. The history of the construction business starts with Noah. The ark was the first large piece of construction work we have any record of. It was successfully carried out, but took a long time to do. The next large job was the tower of Babel. As we know, organization troubles developed. The superintendents, strawbosses, timekeepers and masons who worked on the tower may have been good men in their line, but they couldn't work together. I think that is what the Bible means when it says that they did not speak the same language.

Now, when an owner wants to build something big, he does not have to go around and collect an organization from various parts of the country. There are large construction firms who stand ready to furnish him with just the combination of men he needs for his particular work. Not only are these men good in their line, but they know how to co-operate. They have previously worked on many other jobs together.

To succeed in the construction field, certain natural qualifications are required in

How Carpentry and Cabinetmaking Are Taught to Youngsters Planning Careers in Construction Fields

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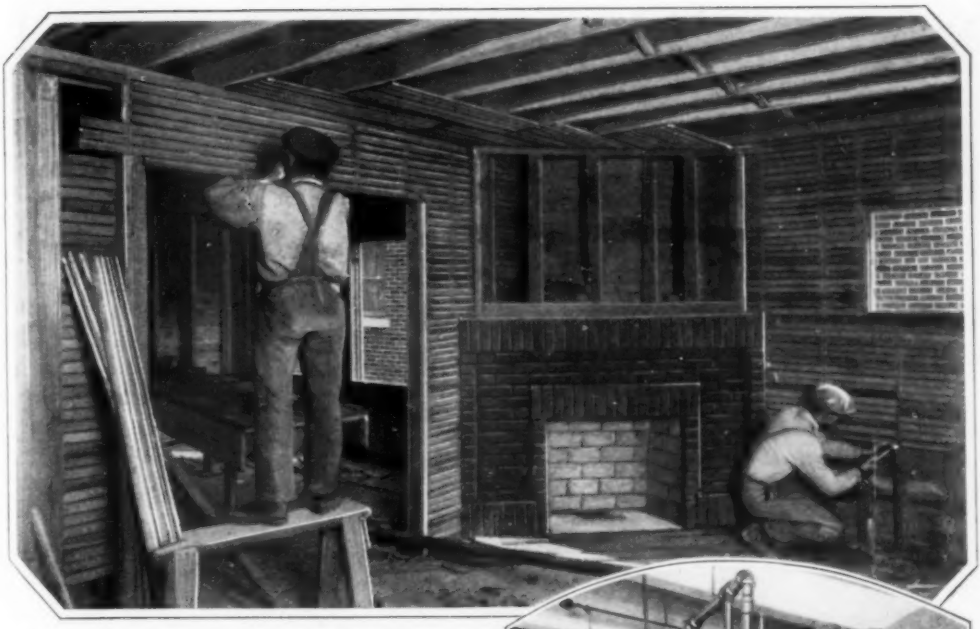

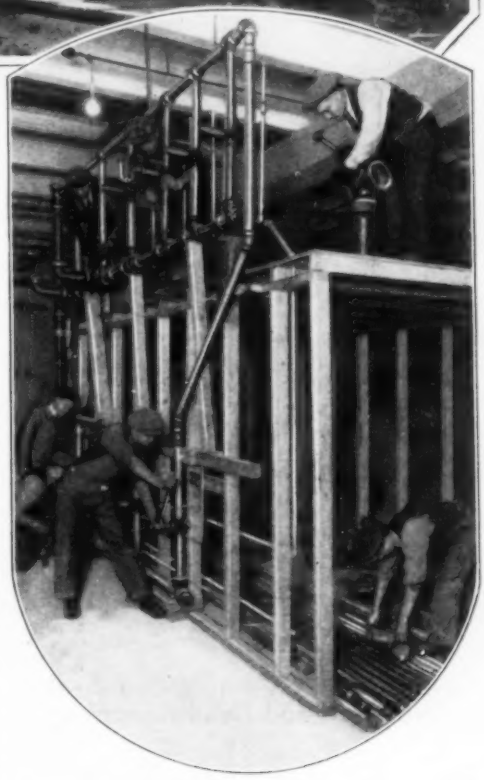

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Above, Part of School in Lathing; Below, Plumbing Class Success Depends on Willingness to Do Hard Work

addition to honesty, sobriety, and industry, which are required in any kind of work. The young man about to enter the construction business should possess enthusiasm, and a willingness to rough it. He must be willing to live in small towns, or even in camps and able to work long and irregular hours.

Technical training is very desirable, but not absolutely essential. Many of the heads of our large construction firms are not technical men. The man with such an education has more confidence in himself, while the man who hasn't got it is likely to think that he is handicapped by not having it. A man who feels this way is, of course, beaten at the start.

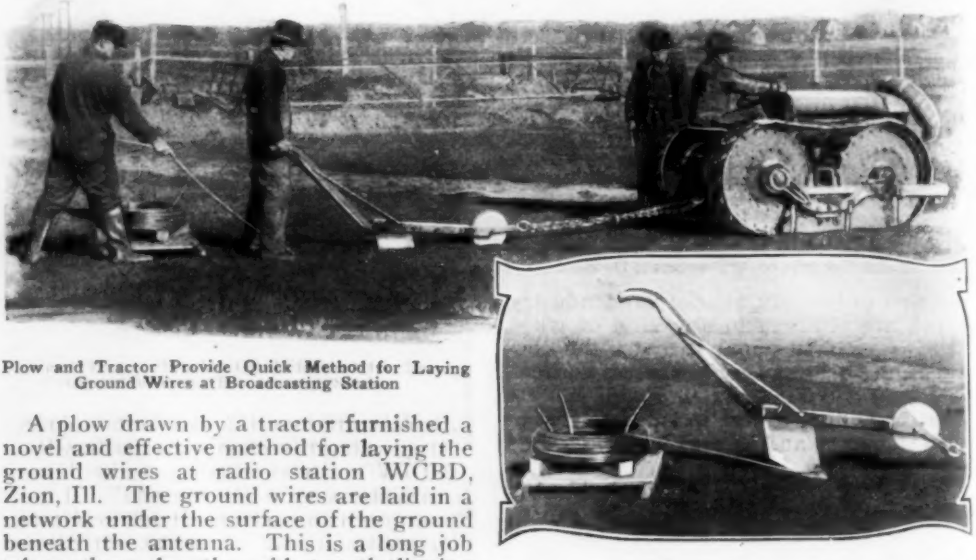
It is desirable that a young man going into construction, endeavor to learn something of all the branches of the business, including the purely office part of the work. He should learn the business from the bottom by doing work with his hands on the job. When I first started out, after graduating from a technical school, I was put to work as office clerk and made up the payrolls, checked the bills, and did all the odd jobs that came up about the office. I began to feel pretty important, because I could wear "store clothes" and had a desk of my own. I also had some authority over the time checkers and material men. One day one of the foremen came in and asked me to help him measure up some lumber. It took quite a long time and we became pretty well acquainted. I had always felt sorry for the men out on the job, but from my foreman friend I learned to my surprise that he and the men on the job felt just that way about me. They had it figured out that I would never

get anywhere as long as I stayed in the office—and they were right.

The next job I applied for, and got, was driving stakes for a surveying party. I soon found out that there is nothing that inspires confidence so much as doing work outdoors, and that the quickest advancements come to those who are not afraid to soil their hands.

The great thing about the construction business is that it is always changing. There is no chance for a man to get into a rut. Opportunities come along quickly and unexpectedly. A man who has been doing a little job well, very soon gets a chance to do a bigger one. In every large construction organization the heads are continually sizing up their men with the idea of trying them out with larger responsibilities. To any young man the possibilities in the construction field are only limited by his ambition and willingness to work. These characteristics are fundamental guarantees of success.

TRACTOR AND PLOW LAY RADIO GROUND WIRE



Plow and Tractor Provide Quick Method for Laying Ground Wires at Broadcasting Station

A plow drawn by a tractor furnished a novel and effective method for laying the ground wires at radio station WCBD, Zion, Ill. The ground wires are laid in a network under the surface of the ground beneath the antenna. This is a long job when done by the old trench-digging method, and this novel solution of the problem is interesting. The wire is fastened to the toe of the plow, as shown in the lower illustration, and is payed out from the coil and laid as fast as the tractor can travel. The wires were laid in parallel rows two feet apart. The total amount of wire laid was 50,000 feet.

Origin of Seagoing Words Traced to Legend and Dead Languages

Tales of the sea and languages no longer spoken have contributed a share to forming the vocabulary of the sailor, according to a naval publication. The word admiral has been traced to the Arabic, amir-el-bahr meaning "lord of the sea"; captain comes from the Latin caput for head and mate from the Icelandic mati, the equivalent for companion or equal. Originally, the coxswain was the man who pulled the after oar in the captain's boat, known as the cockboat, a corruption of the term coracle, meaning a small round craft used in fishing. Commodore is derived from the Spanish comendador and naval cadet was taker from the Provencal capdet, also derived from the Latin caput. Davy Jones is mentioned often in sea stories but there is said to have been no such person. He and his locker find their origin in the West Indian negro term "Duffy," meaning ghost or spirit and Jonah the prophet. The dogwatch was at first the dodge watch, enabling the men to dodge being on duty every day at the same hours. Starboard relates not to the stars but to the Anglo-Saxon steor board from which the old galleys were steered and larboard is believed to be a corruption of lower board, the opposite and inferior to the "steer" side.

How to Avoid Strain on Your Eyes Is Explained by Expert

While the problem of correct artificial lighting is one that often calls for skilled engineers, according to Dr. Charles Sheard of the Mayo clinic, there are certain fundamental rules that almost anyone can follow to avoid unnecessary strain on the eyes. The light should fall directly upon the work, should not be in too great contrast with the general system of illumination and should never be directed into the eyes, this expert declares. Reflections from polished surfaces also should be avoided, as the eye becomes tired in trying to obtain clear images when there is the added brilliance from shiny objects, and flickering, unsteady and streaky lights also produce a fatiguing effect. If woodwork, ceilings, window shades or other objects are too much darker than things around them, a glare is caused that is sometimes harmful, and ground glass should not be used in panes below the level of the eye, as it is said to increase the brightness of images on parts of the retina not accustomed to such light.

Tool for Cutting Holes in Metal Fits in Handbrace

For cutting holes in sheet metal of moderate thicknesses, a tool which can be adjusted for any one of nine sizes up to a diameter of two and three-fourths inches, fits an ordinary handbrace. Extreme pressure or great effort is not required to drill even the largest opening with the cutter. Owing to a movable center pin, which can be readily changed for various-sized holes, great leverage is provided for operation. Perfectly circular openings with smooth and clearly defined edges are produced by the implement, which may also be used to pierce the walls of tanks for the admission of pipes.

Gas Water Heater Made Automatic by Fuel-Control Valve

Gas-burning water heaters of a type that must be lighted by hand, can be made automatic in operation with little trouble, it is said, by attaching a fuel-control valve that turns on or shuts off the gas according to the temperature of the water. The device is strapped to the side of the heater, no holes or drilling being necessary, and consists of a pipe to the main gas supply, one leading to the burner and a pilot light. Within the valve part, which comes in contact with the surface of the boiler, are liquid and metal elements which expand and contract in such a way as the temperature of the water changes that they automatically release or cut off the gas supply to the burner.

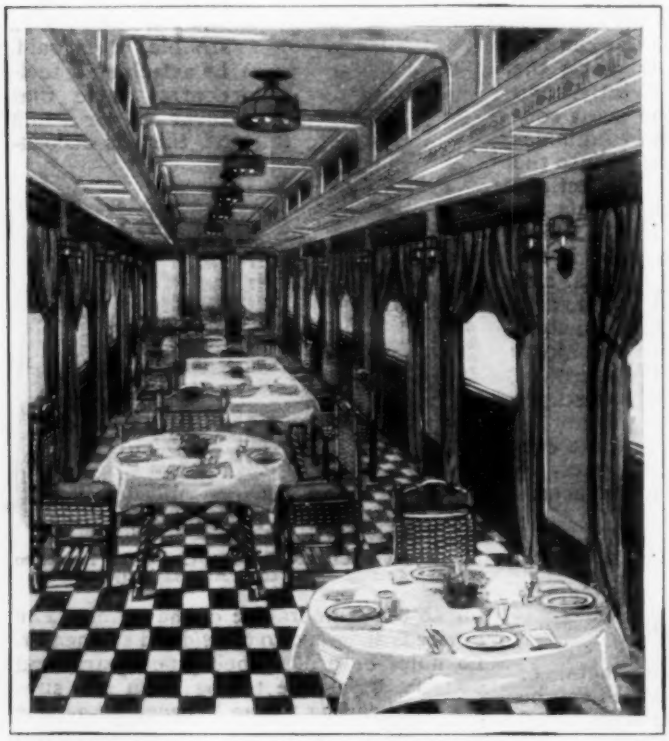
Installing Fuel-Control Valve on Gas Water Heater to Make It Operate Automatically

Sixty Thousand Different Stamps Extant in the World

Postage-stamp collectors desiring a complete assortment from the countries of the world, will have to obtain approximately 63,000 different varieties to make their lists full, for that is the number estimated to be in existence today. Within the last two years, about 4,000 new stamps have been issued by the various governments and, of the total, 23,000 are credited to Europe and 40,000 to the other continents. Most of the rare old American stamps are said to have disappeared in Germany, as American collectors purchased them at relatively low figures when the mark was cheap.

Railroad Dining Room on Wheels Has Kitchen in Separate Car

For special tours through Cuba, a palatial dining car, radically different from the usual type, has been constructed as one of the features of an exclusive six-car train. The conventional center aisle and side tables have been eliminated in favor of five round and one large rectangular table placed along the middle of the car but not in alinement. There are chairs for thirty-eight persons and, as on ocean liners, each tourist is assigned to a special seat for the trip. The kitchen is in the car ahead, thus eliminating odors and hot air from the cooking. Figured-silk hangings and cream-colored woodwork are attractive details of the decorative scheme.



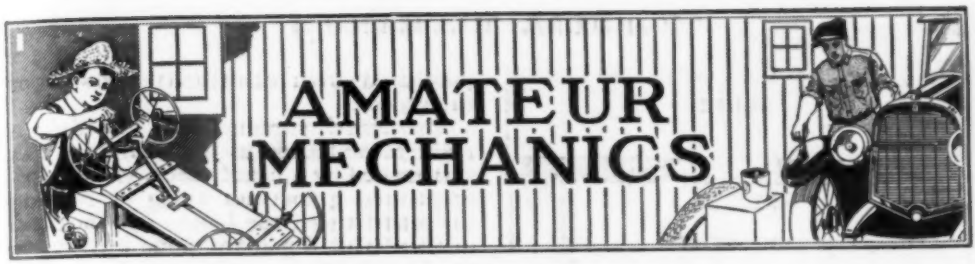
Inside Kitchenless Restaurant Car Where Novel Table Arrangement and Window Hangings Give Effect of an Airy Cafe

Roaches Give Clue to Rich Gold Mine Lost One Hundred Years

Cockroaches and the persistence of a young American engineer have led to the rediscovery of a gold mine in Mexico that had been lost for 115 years, it is reported. The vein was operated by Spaniards in the time of Cortez. They gave it the name La Cucaracha, Spanish for cockroach, because of the large numbers of the insects that infested the rocks. When the Mexican rebellion occurred in 1812, the miners fled, sealing the entrance to the shaft. The secret of the rich deposits perished with the priests, and records in the church writings were lost when the building was destroyed. Tales of the treasure persisted, however, and though none could find it, the young engineer who had been befriended by an aged priest during the revolution against President Diaz and had been told of the mining operations by his host, started search. He first discovered a new vein, and while hunting near this property, chanced on the old mine, the entrance to which was almost obscured by thick growth. He was lowered into the pit and was satisfied that his hunt had been rewarded by the presence of swarms of cockroaches on the walls. The old ore vein, said to be over sixteen feet wide, is now being worked, according to reports, and is proving rich in silver and gold.

Auto Lights Dimmed by Foot Switch to Spare Hands for Driving

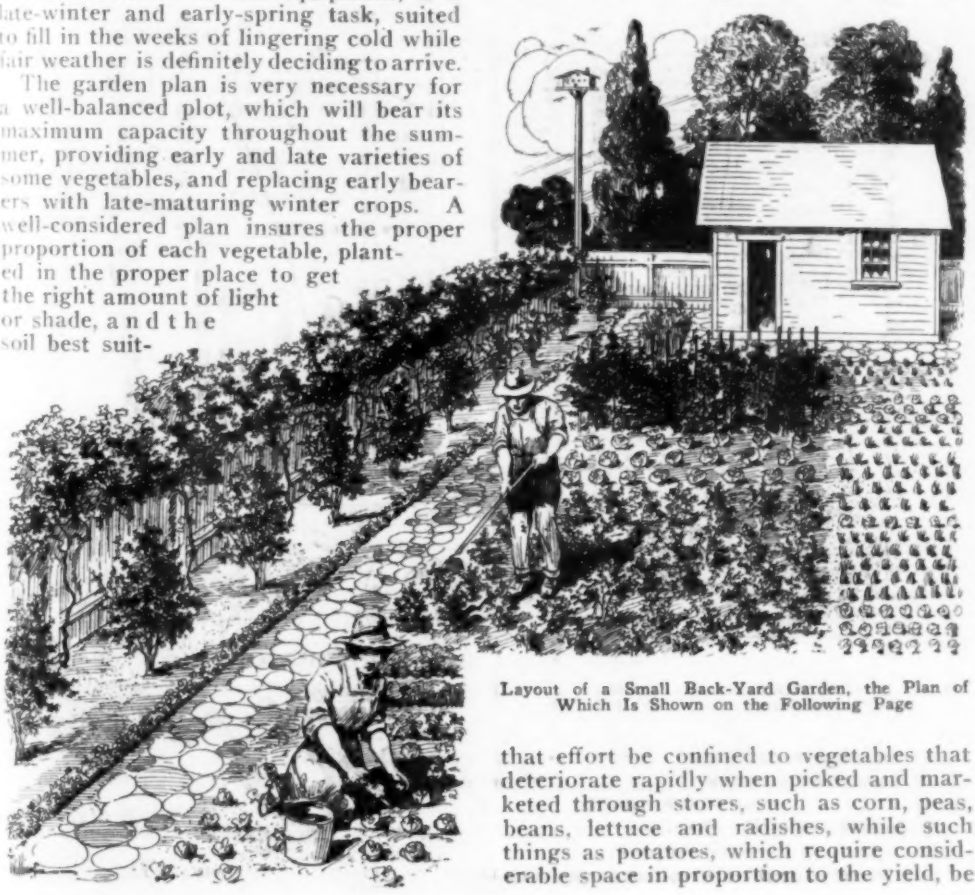
Placed in any convenient position on the floorboard of the car, a push-button switch operated by the foot for dimming the headlights has been devised. It eliminates the necessity of removing the hands from the steering wheel to search for a dash key or switch, thus making it easier and safer to drive at night. The connecting wires are easily concealed and the installation does not interfere with other attachments on the car.



Planting the Back-Yard Garden

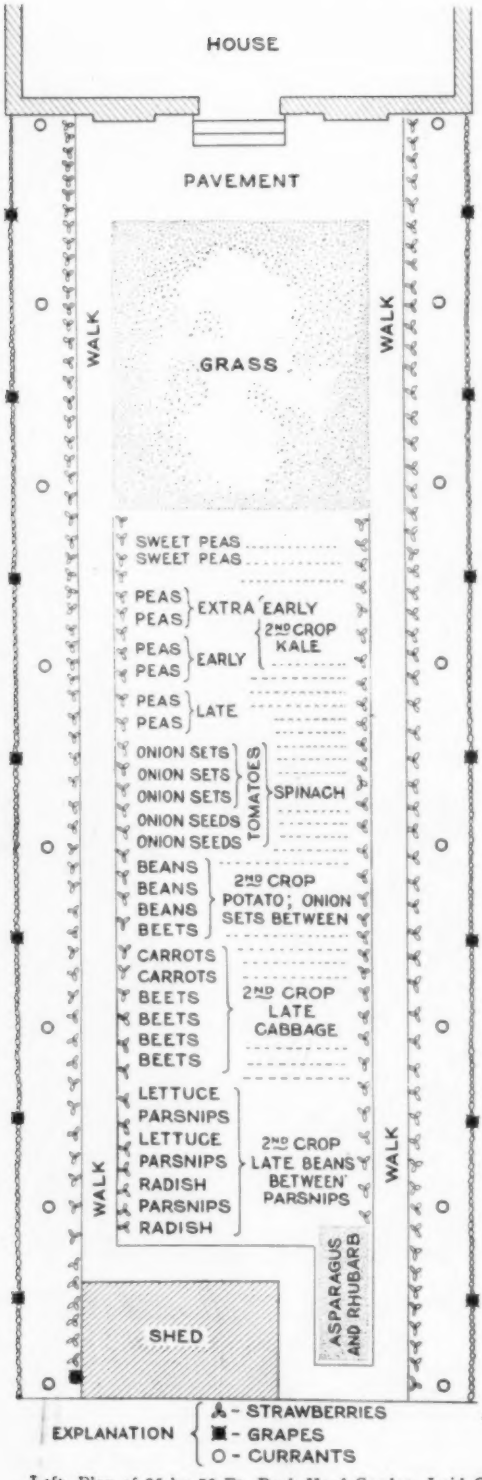
PREPARING the tools and buying the seed and equipment for the back-yard garden is one of the most enjoyable, besides being the easiest, parts of being a home gardener. But many a garden that started off with high hopes in the spring has withered and died in midsummer for lack of attention, due mainly to lack of proper tools to lighten the work of cultivating. Planning the garden and laying in the supply of seeds desired, overhauling the tools and making or buying needed additions to the equipment, is a late-winter and early-spring task, suited to fill in the weeks of lingering cold while fair weather is definitely deciding to arrive.

The garden plan is very necessary for a well-balanced plot, which will bear its maximum capacity throughout the summer, providing early and late varieties of some vegetables, and replacing early bearers with late-maturing winter crops. A well-considered plan insures the proper proportion of each vegetable, planted in the proper place to get the right amount of light or shade, and the soil best suited to its growth. One of the best back-yard garden plans, recommended by the department of agriculture, was applied in a 25 by 70-ft. yard in a New York city suburb, and yet in that fairly small space included such permanent plants as grapes, strawberries, currants, beds of asparagus and rhubarb, and early and late peas and onions, sweet corn, cabbage, beans, beets, lettuce, parsnips, radishes, potatoes, kale and spinach, as well as peppers and egg-plant. In the main, the department in its bulletins on home gardens recommends



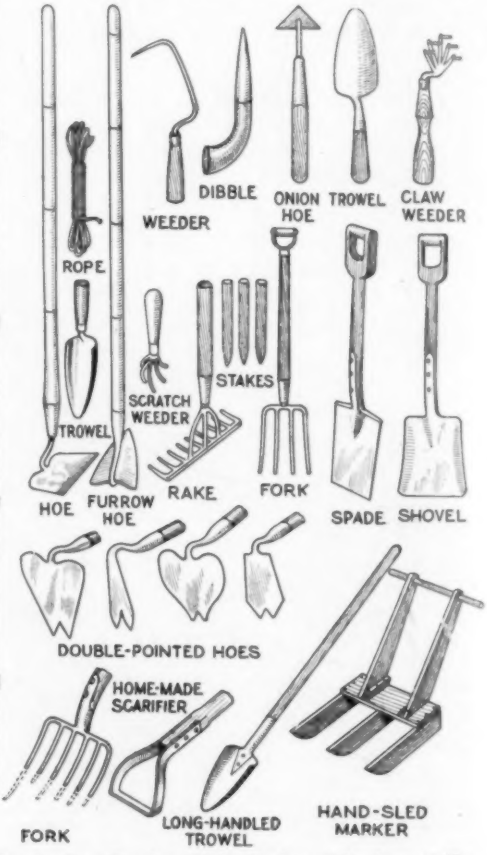
Layout of a Small Back-Yard Garden, the Plan of Which Is Shown on the Following Page

that effort be confined to vegetables that deteriorate rapidly when picked and marketed through stores, such as corn, peas, beans, lettuce and radishes, while such things as potatoes, which require considerable space in proportion to the yield, be



purchased from commercial growers or the grocer.

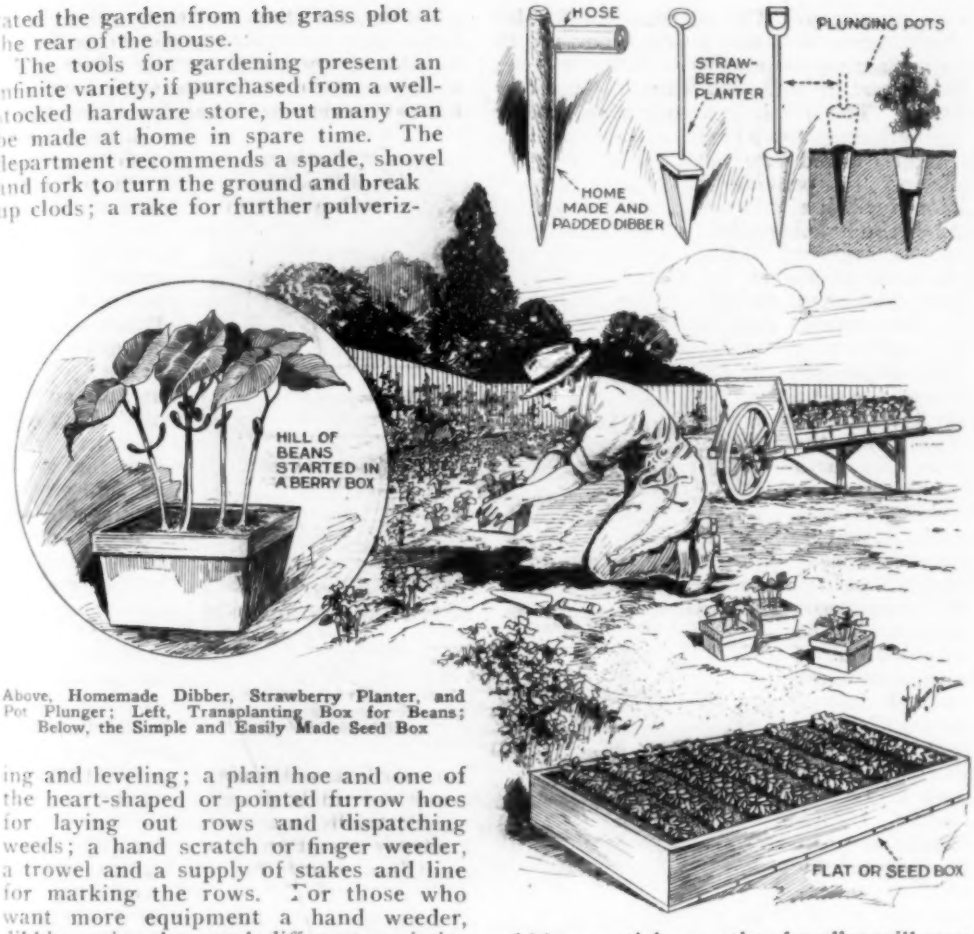
The model garden which the department recommends as an ideal type was surrounded by a board fence, so the owner planted grapevines along it, training the tendrils over the fence. He then laid out walks of flagstones some 5 ft. inside the fence, and along the outer edge of the walk set out his strawberry plants. Between strawberries and the grapes, he set out currant bushes and, in the space between the bushes and the strawberries, planted low-growing vegetables, such as bush beans, peppers and eggplant. In the space, about 12 ft. wide, between the walks he planted low-growing, quick-maturing vegetables in such a way that later-maturing varieties could be set out between them. At the rear of the lot, alongside the shed, beds of asparagus and rhubarb, which come up fresh each year, were planted where they would be out of the way of tilling the main garden. Two rows of sweet peas, trained over a trellis, sepa-



Left, Plan of 25 by 70-Ft. Back-Yard Garden, Laid Out for Best Results; Right, Tools and Implements Useful for the Amateur Gardener

rated the garden from the grass plot at the rear of the house.

The tools for gardening present an infinite variety, if purchased from a well-stocked hardware store, but many can be made at home in spare time. The department recommends a spade, shovel and fork to turn the ground and break up clods; a rake for further pulverizing and leveling; a plain hoe and one of the heart-shaped or pointed furrow hoes for laying out rows and dispatching weeds; a hand scratch or finger weeder, a trowel and a supply of stakes and line for marking the rows. For those who want more equipment a hand weeder, dibble, onion hoe and different varieties of scarifiers and weeders are included.

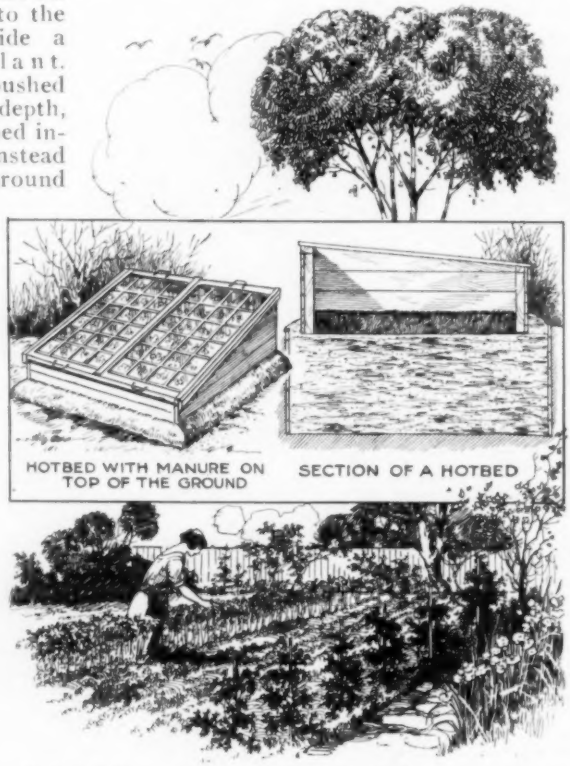


Above, Homemade Dibber, Strawberry Planter, and Pot Plunger; Left, Transplanting Box for Beans; Below, the Simple and Easily Made Seed Box

The man who likes to make his own tools can improvise many of the necessities, as well as luxuries, of gardening from other things. An ordinary manure fork with the tines cut off to a length of 6 or 7 in. makes an acceptable garden spading fork for working in mellow soil. It does not slice the soil, as a spade would, but tends to break it up into smaller and more irregular masses. With heavier soils, where a spade is used in turning, a blow or two on each shovelful turned over will crack up the lump.

An old hoe, of the plain rectangular variety, can be ground down into a heart-shaped one, or a two-pointed weeder that will get into the close spaces around delicate plants and cultivate the ground without injury to the vegetables, while stirring the soil much deeper than the original hoe could go. Weeding spuds and scarifiers made of simple loops of iron mounted on old broomsticks or other handles will save a lot of back-breaking work. Many varieties of weeding hoes can be made from flat pieces of sheet iron, cut to the desired shape, given a ground edge, and attached to handles. A straight bar of iron, bent into a U-shape, attached to a handle and given a sharp edge, makes a good hand weeder, a short handle being used for close work and a long one for the easier tasks. Garden experts recommend that when a trowel is purchased, an extra amount be spent to get one in which the trowel fastening runs through the length of the handle, terminating in a nut or rivet at the upper end. If a broken trowel of the other design, in which the handle fits into a socket, is available, the old handle can be replaced with a long broomstick, and much trowel work done without bending over. A weed spud, made of a flat steel blade attached to the handle of an old shovel, can be made more useful by the addition of a brace in the form

of a footstep. The dibbers or dibbles (both terms are used) are necessary in transplanting vegetables which are given their start in hothouse frames or window boxes. The dibble is simply a conical or flat implement which can be pushed into the ground to provide a hole for the plant. After the hole is pushed to the required depth, the plant is dropped into it and then, instead of filling in dirt around the roots, the adjoining earth is tamped against the plant with the foot. No earth is removed in making a hole with a dibber, as it is simply pushed aside. A serviceable dibber can be whittled out of a stick, or made from a forked branch of a tree, with the side limb cut down for a handle. The handle part can be softened by slipping a section of old rubber garden hose over it.



Method of Constructing Hotbed and Installation over the Underground Manure Pit

For setting out plants with large roots, such as strawberries, a large flat dibber is used. It can be made from a piece of 2 by 4-in. stock, cut down to a wedge shape, and with a flat piece of 1-in. material nailed to the top, projecting all around, to be used both as a footrest in pushing the dibber into the ground, and to regulate the depth of the hole. A handle of iron bar may be added, setting it to one side to give plenty of room for the footrest.

It is not necessary to wait for the warm days of spring to start planting, since hotbeds, cold frames and seed boxes are easily made. The hotbed and cold frame may be combined by hinging the glass covering-frames so that they can be raised bit by bit to accustom the plants to the outdoor temperature. Early lettuce started in a hotbed will be ready for the table even before the garden can be worked. Hills of beans, tomatoes and many other vegetables may be started in the house in old wooden berry boxes or any other available receptacle and attain a good start in life before they are transplanted outdoors. Cucumbers, melons, sweet corn and other warmth-loving plants thrive when started in old berry boxes. When the time comes for transplanting, the bottom of the box may be cut away and the "hill" planted by sinking the box and its contents in place in the garden, leaving the sides just as they are. The flat or seed box which is kept in the house is, perhaps, the most practical device for use by the home gardener for starting early vegetables. By its use earlier crops of tomatoes, cabbage, cauliflower, Brussels sprouts, peppers, eggplant, and lettuce can be had with little outlay for equipment. Early potatoes are sometimes forced in the same way. Seeds so planted germinate and are ready for transplanting by the time it is safe to sow the same kind of seed in the open ground. When danger of frost is over and the soil dry enough to work, therefore, the early garden may be started with seedlings well above the surface. Transplanting, if properly done, instead of injuring seems to help such plants to develop a strong root system.

Any sort of wooden box filled with good soil answers the purpose, but the department of agriculture recommends the following specifications: Construct a box 3 to 4 in. deep, 12 to 14 in. wide and 20 to 24 in. long; place a layer of about 1 in. of gravel or cinders in the bottom, and then fill nearly to the top with rich garden

soil, or soil enriched with decayed leaves or other fertilizer; press the soil down firmly with a small piece of board, and scratch rows, ¾ to ½ in. deep and 2 in. apart, crosswise of the box.

The seed should be distributed eight or ten to the inch in the rows, and covered with soil, and the box put in a warm light place and watered. The best location is just inside a sunny window. Water enough must be given from time to time to cause the seed to germinate and grow thrifty, but not so much as to leak through the box. If the surface is covered with a piece of glass, resting on the edges of the box, it will cause the soil to hold the water and hasten the germination of the seeds. When the plants are from 1 to 1½ in. high, they should be thinned to 1 or 2 in. apart in the row, so as to give room for development. If it is desired to keep the plants thinned out they may be set out 2 in. apart in similar boxes pending transplantation outdoors. When the weather becomes mild, the box should be set outside part of each day, so that the plants may "harden off" in preparation for removal to the garden. A good watering should be given the plants just before they are taken out of the box, so that a fair ball of earth will stick to the roots of each.

The hotbed may be built of old lumber, 12 in. high on one side and 8 in. on the opposite side, so set that the inclined glass top will receive the maximum of sunshine. The size of the box may be regulated to fit old window sash, if they are available, or it may be built 6 ft. wide and in any multiple of 3 ft. in length so that standard hotbed sash will fit it. The hotbed must not only catch the heat of the sun but must generate heat of its own through the fermentation of a bed of manure placed beneath it. An excavation about 18 in. to 2 ft. in depth should be made, about 2 ft. greater in length and breadth than the hotbed frame, and with walls lined with planks or concrete. A drain to carry off surplus water to a lower part of the garden may be made of tile or by digging a trench and filling the bottom with loose stones, covered with earth.

The excavation is filled to the ground level with manure, and the frame set in place. The sides and ends are then banked nearly level with the top of the frame. Three inches of good soil should then be placed on the manure inside the frame, and the sash put in place. After the heat from fermentation has reached its maximum and subsided to about 80 to 90° F., it is safe to plant the seed. The bed should be kept partly dark until the seeds germinate by covering it with muslin, cheesecloth or some other light substance. After germination, the plants will need all the light they can get, except direct rays of the sun. Both watering and ventilation also should be carefully regulated to get a good growth. Watering may be done in the early morning on clear days, with ventilation following immediately so that the foliage may dry and to prevent mildew.

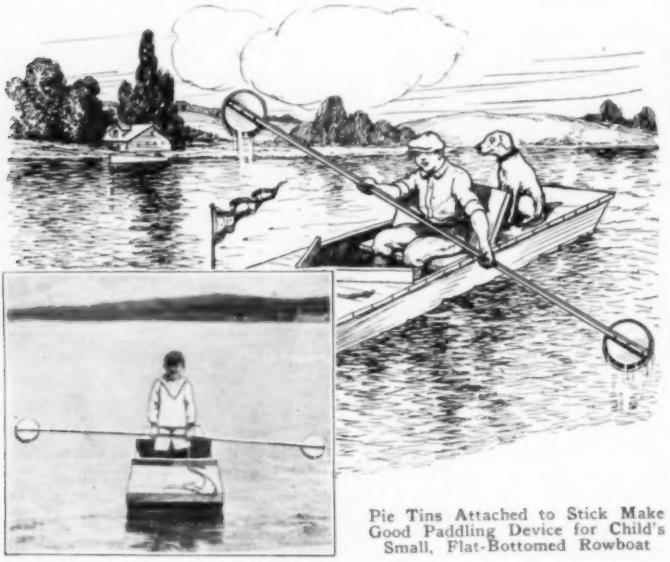
The arrangement of the open garden plot will have much to do with its success. The plan should be carefully laid out on paper in advance. Rows should preferably extend from north to south, to insure an even distribution of sunlight to all plants. All permanent vegetables, such as rhubarb, asparagus and herbs should be planted at one side where they will not be disturbed every year. Tall vegetables, such as corn and pole beans, should be placed so as not to shade their smaller neighbors. Early planted and early maturing vegetables should be grouped, so that later varieties may take their place later on, or between the rows. If pumpkins, squash or other vine plants are to be grown between the rows of corn, they need not be set out until after the corn is well above the ground, insuring that the sweet corn will keep well ahead of the vines, and not be choked by their tendrils or shaded. Rows should be laid out with a marker or with a line stretched between two sticks, in order to keep them straight and evenly spaced, insuring greater ease in cultivation.

The department of agriculture has compiled very complete statistics on the cost and labor required in planting and tending scores of boys' and girls' school gardens and many family plots. Returns from 149 gardens, each about 2,800 sq. ft., show an average cost of $4.82 with about 58 hours' labor during the season to care for each garden. The same figures show that the small plots of 500 sq. ft. or less, capable of receiving more intensive care, produced a proportionately greater return than much bigger plots. Twelve gardens averaging 305 sq. ft. each produced an average of $6.95 worth of vegetables, at a cost of 84 cents per garden, and 28 hours' work on each plot. Eight averaging 1,909 sq. ft. required an average of 39 hours' work, cost $2.51 and raised $14.46 worth of vegetables each.

The best big garden visited by the government inspectors contained 8,800 sq. ft., cost $25 to maintain, required 200 hours' work, and gave an income of $231.82 from truck grown in it.

Paddle for Child's Rowboat

Rowing with big oars is a hard task for a five-year-old boy, but nevertheless, he is usually determined to row. A small flat-bottomed boat was made specially for a boy at a lake resort, and instead of regular oars, two pie tins were screwed to the ends of a stick about 7 ft. long, as shown in the photo. Using this as a paddle, he was able to handle the boat easily.



Pie Tins Attached to Stick Make Good Paddling Device for Child's Small, Flat-Bottomed Rowboat

Simple Bottle-Cork Holder

Corks are easily lost unless care is taken to replace them immediately after using the bottle or unless some means is provided for keeping them attached to it. A simple device, that can be removed when the bottle is thrown away, is shown in the illustration. It is made of two short lengths of wire bent as indicated, one length being formed to a clamp to grip the neck of the bottle and the other length stuck into the top of the cork. Eyes in both lengths hold them together. In places where a great number of bottles are in constant use, as in physicians' offices, these holders are very convenient.—Dr. Chas. E. Morse, La Junta, Colo.

Vulcanizing Golf Balls

When golf balls become cut and otherwise disfigured they are usually discarded. However, with the aid of an electric soldering iron, a cut ball can easily be vulcanized, provided the iron is not allowed to become too hot. The paint is first removed from the ball by dipping it in a solution of lye, and the cut area is heated with the iron until it becomes soft and plastic at the edges of the cut. Then, by firmly pressing the edges together with the fingers until the rubber is cool, the cuts will become sealed. In some cases, a piece of the cover is lost when the ball is cut badly, but if not too large, a piece of a discarded ball cover may be cut to fit the crack and pressed in when heated. In half an hour the repaired balls may be repainted by pouring a little golf-ball enamel in the palm of the hand, rolling the ball between the hands until it is thoroughly coated, and placing it on the points of four nails driven through a board, to dry. However, there are some golf balls that are of such composition that they cannot be repaired in this way.—S. A. Marshall, Jr., Atlanta, Ga.

How to Care for Your Brushes

Brushes for applying oil paints must be well cleaned after using, although for keeping overnight it is generally sufficient to wrap them in several thicknesses of paper. Some painters keep their brushes overnight by putting them in water. If the brush is not to be used for several days the paint should be washed out of it thoroughly. Turpentine is one of the most satisfactory materials for washing a brush, but it is expensive, and a brush can generally be washed as well in kerosene, which is much cheaper. After washing off a brush with kerosene it should be rinsed with gasoline or benzine, then thoroughly shaken and well washed with soap and warm water. When this has been done the brush should be shaken thoroughly so as to throw out as much water as possible and hung up, with the bristles down, until dry. It should then be

wrapped or protected from dust in some other convenient way.

If much painting is done it is more convenient to keep the brushes in kerosene or turpentine. For this purpose hooks should be fastened on the inside of a pail with a close-fitting cover, and the brushes suspended from the hooks, either by drilling holes in the handles or by fitting them with loops of string so that they hang in the liquid; the bristles should be completely submerged, but should not touch the bottom of the pail. When kerosene is used for cleansing, it should be removed by shaking and the brush rinsed in turpentine before using it again for paint.

Brushes used for whitewash or calcimine should simply be thoroughly washed, and should not be put in the same liquids in which the oil-paint brushes are kept. A shellac-varnish brush should be kept in alcohol or in the varnish itself. Generally speaking, a varnish brush should be kept in the varnish for which it is used.

Nursing Kids Artificially

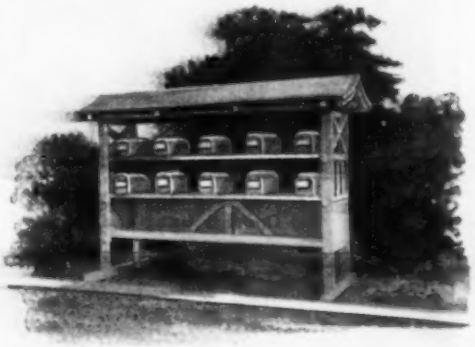
Finding it difficult to induce young kids to drink milk on a California goat farm, the method shown in the photo was resorted to and found practical. Sheet-metal tanks, 2 by 1 by 1 ft. in dimensions, were equipped with three small spouts, over which were fastened ordinary rubber nursing nipples. The spouts were simply bushings soldered to the bottom of the tanks. This arrangement permits the kids to feed

Milk Tanks Provided with Nipples Nurse Kids on a California Goat Farm

in a natural way and the only difficulty experienced is that all the kids want to nurse on the same nipple.

Neat Mailbox Rack Improves Country-Road Corner

Most mailboxes along country highways are mounted on posts, and, at some corners, where large clusters of them are

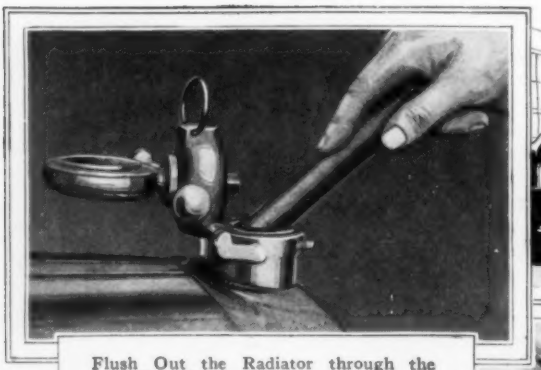


"Apartment" Mailbox Shelter Improves Appearance of Country Roadside

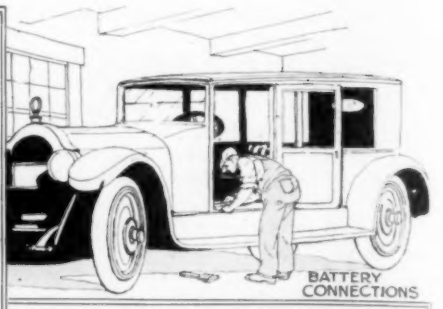
assembled in a more or less haphazard manner, they easily become an eyesore on an otherwise pleasant roadside. However, by providing an "apartment" mailbox shelter of the kind shown in the photo, this objectionable feature is easily overcome. This shelter is made of a 2 by 4-in. frame and has two or three shelves of 1-in. material, and a neat roof to harmonize with the rest of the construction. The latter is covered with colored asphalt or asbestos shingles. The mailboxes are arranged side by side and are screwed down securely to the shelves. The whole affair is given a few coats of white paint to protect it against the weather. —E. H. Morton, Portland, Oreg.

Separating Telescopic Fishing Rods

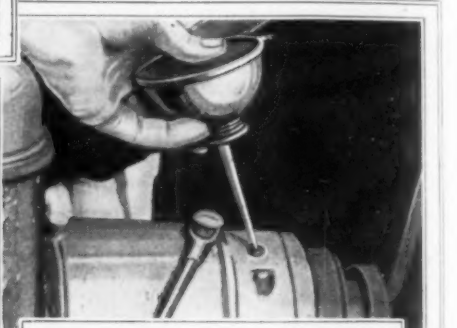
In spite of the light coating of oil which all good fishermen use on the ferrules of their fishing rods, the sections sometimes become so tightly wedged together that it is almost impossible to pull them apart. If a slight twisting pressure does not loosen them, do not attempt to apply greater force, for a good rod is easily strained by such treatment. Instead, light a match and hold it under the outside member of the offending joint until it becomes quite hot. This will expand the thin metal of the socket sufficiently to make the separation of the two sections an easy matter.



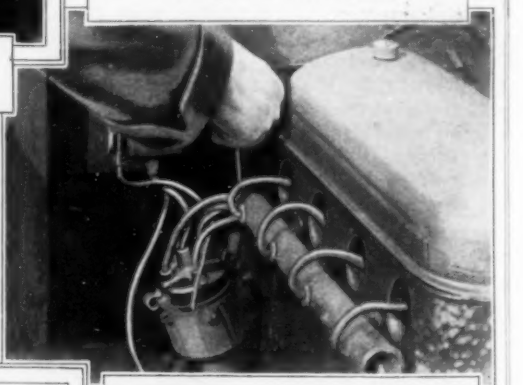
Flush Out the Radiator through the Top Opening, Using a Hose



See That the Clamps Are Tight on Both Upper and Lower Hose Connections



Oil the Generator and Starting-Motor Bearings and Drive Chains



Inspect the Distributor Wires, Tape, and Tighten the Terminals

Clean the Spark Plugs Thoroughly and Adjust the Points to the Correct Opening

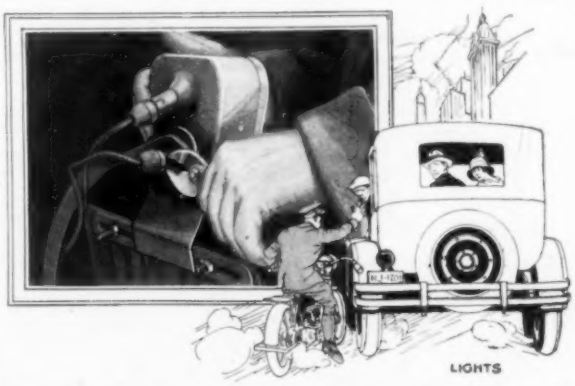
Preparing the Car for Summer Driving

How Owner Can Put Automobile in Shape for Warm Weather and Remove Troubles Accumulated during Winter

By J. EARLE MILLER

WITH the approach of the summer touring season, what does the car that was laid up for the winter, or the one that was driven throughout the cold months, need to put it in shape for efficient use? Unless worn parts are to be replaced or remachined, the owner can do all of the work himself in a comparatively short time. For the average motorist, removing the top of the cylinder block to get rid of carbon is too much of a mechanical task, and should be left for the garage repairman, along with such jobs as regrinding cylinders, fitting oversize piston rings, tightening bearings and truing up the crankshaft.

But, if the car was driven all winter, the owner can easily remove the light winter oil and substitute a heavier summer grade. He can flush out the cooling system, and there is more to this than just opening the lower petcock to drain the radiator. After it is drained, a hose should be inserted in the radiator intake, the water turned on, and the engine then run for five minutes, while the pump sucks the water through the entire system and passes it out the petcock, along with all loose rust and other foreign matter. If the cock can be removed, so much the better. At the same time the rubber-hose connections between radiator and engine should be inspected, for some anti-freeze solutions rot rubber, and new ones may be needed in the spring.



See That All the Lights Are Burning Properly and That the Contacts Are Tight

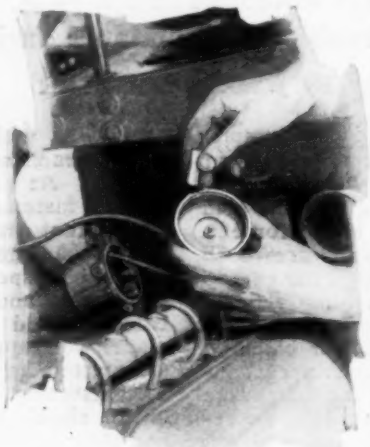
About 75 per cent of all the operating troubles of motorists are traced to the electrical system. A bit of foresight may avert an untimely halt on a summer's tour. Remove the battery connections, clean them and the posts, removing the winter's accumulation of corrosion, then grease them well with vaseline and make sure the terminals are fastened as tight as they can be. At the same time examine the battery fastenings and see to it that the box cannot rattle around in its container and so damage itself. The battery leads should be inspected for worn places in the insulation, and if any are found, new cables should be installed or the worn places well taped. Many automobile fires are started by worn-out electrical cables. The fastening of the cable to the starter switch should be tightened, if it needs it, and the wires to the distributor inspected, tightened and taped, if worn.

The starter and generator are probably badly in need of oil, and at the same time should be inspected for loose or worn bearings. A worn bearing may let the armature rub against the fields and damage it so badly a new one will be required, if the trouble is not corrected. Spark plugs should be cleaned and readjusted. A thin dime pressed between the contact points will give the correct distance. Many motorists find it pays to install a complete new set of plugs each spring.

A loose fan belt, which allowed the fan to idle along, may not have been noticed in the winter, but with the coming of warmer weather it should be looked after to insure proper cooling of the engine. It will pay, too, to go over the lighting system and ascertain that all brackets are tight and the lamps in working order. This is particularly true of the tail light. The stop light may be inspected at the same time to make sure that when the brake pedal is pressed the stop-light switch works. The wire connection from brake pedal to switch has a habit of growing too long after a few months' operation, unless

833

carefully watched. Quite a bit of work can be done to the running gear by the owner, with the saving of a considerable garage bill. Wheels should be removed and greased. While the back wheels are off, clean the mud and grease off the brake housing and parts, and squirt penetrating oil into the shackles. Locked brakes, which have wrecked many a car, may usually be traced to an accumulation of rust in the joints of the moving parts. Some of the higher-priced cars use brass or bronze bushings there, but in the medium and low-priced machines, where steel rubs directly on steel, rust will accumulate. A good penetrating oil will dissolve the rust and keep the parts working, and perhaps avert a serious, if not fatal, accident.

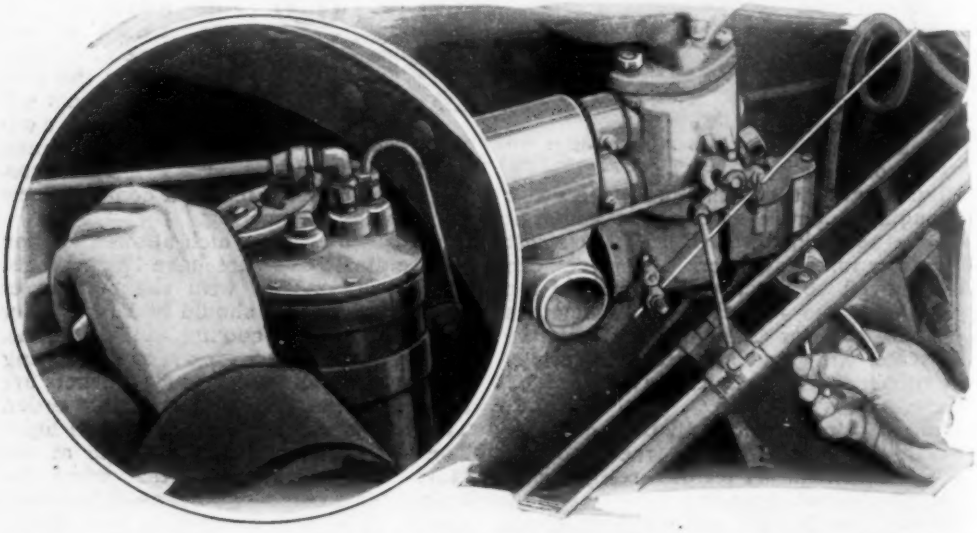


Clean Off the Inside of the Distributor and Adjust the Points

All grease cups on the car should be removed, filled and then screwed down as far as they will go, forcing out all the old grease from the bearings. Then remove the cup, refill and screw it down again. That is the only way to get rid of the old dirt and foreign matter with old-style grease cups. If the car is equipped with one of the pressure-feed lubricating systems, the grease gun will perform the entire task at one operation. Give the body bolts the "once over" with a wrench. They are bound to have worked a bit loose after a winter's hard driving, with resulting distressing body squeaks. All body bolts should be tightened at more or less regular intervals, if you want a quiet and pleasant-riding car. Also jack up the body of the car, pry apart the spring leaves, and coat them with a good graphite grease.

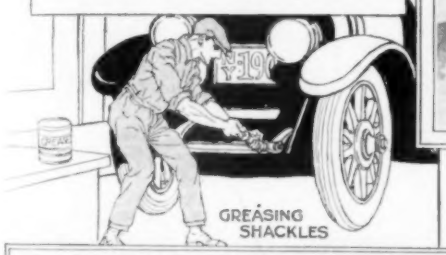
The gasoline system and carburetor need attention, too. The needle valve should be readjusted to a summer mixture, somewhat thinner than that used during the cold months. Next, the drain at the bottom of the vacuum tank should be opened and the water and dirt drawn off. If it is left in, it eventually will find its way into the carburetor. Also, the screens in carburetor and vacuum-tank intakes should be removed and cleaned.

For the car that was laid up over the winter, much of the same general inspection and overhauling may be applied. If properly put away, the radiator and gas tank were drained, crankcase oil removed, the car blocked up and the tires taken off.

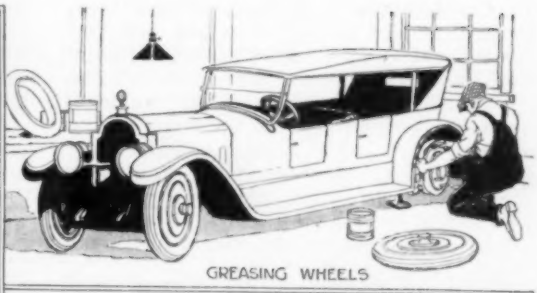


Left, Remove and Clean the Strainer in the Vacuum-Tank Intake; Right, Remove the Strainer in the Carburetor and Clean the Sediment Out; Clean Out All Carburetor Passages

Use Penetrating Oil on All Moving Parts of the Brake Mechanism

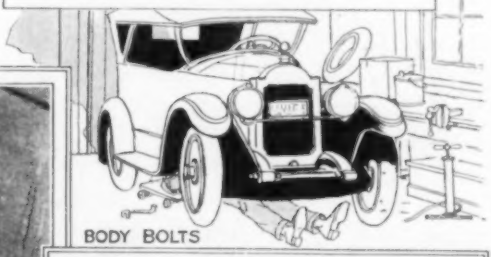


GREASING SHACKLES



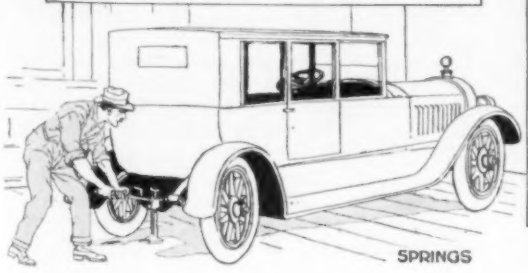
GREASING WHEELS

Lubricate the Shackles on the Springs with Oil or Grease



BODY BOLTS

Go Over All Parts of the Steering Gear, Inspect and Lubricate



SPRINGS

The Steering-Gear Drag Links Need Frequent Oiling

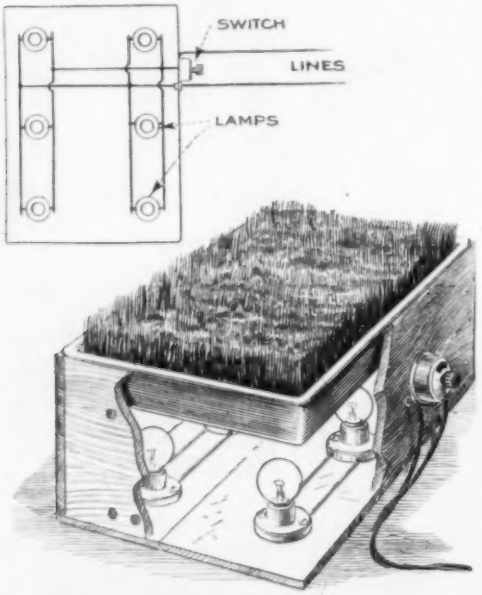
In the latter case, before putting them back, it would be well to clean any rust from the rims with emery paper, and paint both rim and wheel with shellac and graphite. This will insure easy removal in case of tire trouble on the road. With modern tires, which stand up for many thousands of miles, the rims frequently are rusted tight to the wheels when occasion comes to remove them.

The car laid up for the winter needs the same general inspection of electric system, cooling plant, starter, generator, running gear and greasing. If the battery was left at the service station for the winter, it will come back in good condition.

When the gasoline tank is filled for the first time in the spring, it may be necessary to open the vacuum tank and fill it, then start the engine running until the vacuum feed draws the gas up from the rear supply tank.

Electrically Heated Sprout Box Aids Garden

An electrically heated sprout box of the kind shown in the illustration will enable

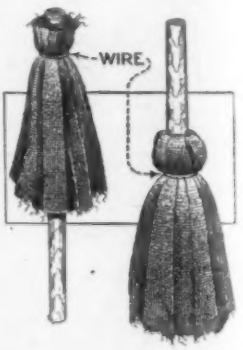


Simple Sprout Box, Heated by Electric Lamps, Assists in Early Germination of Seeds

one to germinate seeds early in the spring and thus get good-sized plants into the garden when most folks will be planting the seeds. Boys who raise truck on the side for spending money know that a few days make a lot of difference. Vegetables are high-priced early in the season but later, when the market is flooded with produce the price naturally drops. So the early produce pays by far the biggest returns. The device consists of an ordinary wooden box with four or six electric lamps set in sockets fastened to the bottom as indicated. They are wired up as shown and connected to a snap switch, which is screwed to the outside of the box. An extension cord, about 10 or 15 ft. long, enables one to connect it to a lamp socket in the basement. An ordinary beveled bread pan, fitting snugly over the top, is used to hold the earth in which the seeds are planted. Heat from the lamps maintains a growing temperature in the soil, even in freezing weather. However, if the outside temperature is very low, a covering must be provided over the box. It will be easier to fit the box to the pan than to find a pan which will just fit the box; so the pan should be selected first. It should have tapered sides and a wide rim. Then the box should be built so that the pan will just fit snugly in the top, as shown. The box should be about 8 in. high.

Old Stockings Make Mop

Old cotton stockings, which are usually thrown away, may be made into serviceable mops. After cutting off the feet, each stocking is ripped down the side from end to end. Then, placing the pieces side by side, sew the upper corner of each piece to the piece next to it. Tack one end of this assembly to an old broom handle, about 2 in. from the end, and twist a piece of copper wire around them as shown in the left-hand detail. Reversing the position of the handle, so that the strips will hang over the end, as shown in the right-hand detail, twist another piece of wire around the outside, about 1 in. from the end of the handle. Each piece is then cut or ripped into ribbons about 2 in. wide, and the mop is complete.

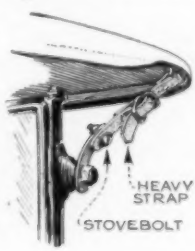


Waterproofing Cloth

Cloth or canvas can be readily waterproofed to resemble slickers or oilskins, thus making it suitable for boat tops, truck tops, aprons or any kind of waterproof clothing or hats. Take 1½ oz. of yellow laundry soap, shave it thin, and dissolve it in ½ pt. of soft water over the fire. Bring it to the boiling point, and slowly stir in 1 qt. of boiled linseed oil. The oil must be added a little at a time and given time to heat up before adding more, and the stirring must be constant while the oil is being added. If carefully made the mixture will resemble mayonnaise dressing, but if not made carefully the oil will separate from the soap and water. Even after they are properly mixed, the addition of any pigment to color the mass will cause a separation of the ingredients. Stretch the cloth to be treated in some suitable place, where it will be kept clean, and apply the dressing with a paintbrush. Three coats should be sufficient, giving each coat time to dry before applying the next. This makes slicker cloth that will always remain soft and pliable, and never become sticky. If the canvas is to be stretched on a frame, it should be waterproofed first and then stretched on. If put on first and later waterproofed, it will sag and become very loose after the dressing has been applied.—J. H. Downie, San Antonio, Tex.

Silent Top Buckle for Ford

The buckles on the straps used to hook the top to the windshield on the older models of Ford cars, often rattle loudly. To eliminate this, many drivers tighten the straps until a severe tension is placed on the top. A better remedy is to substitute a heavy leather strap, about ¾ by 6 in., and provided with a buckle. A ¼-in. hole is drilled near the end of the strap, as shown in the illustration, to receive a stovebolt with which it is fastened to the metal arm on the windshield.

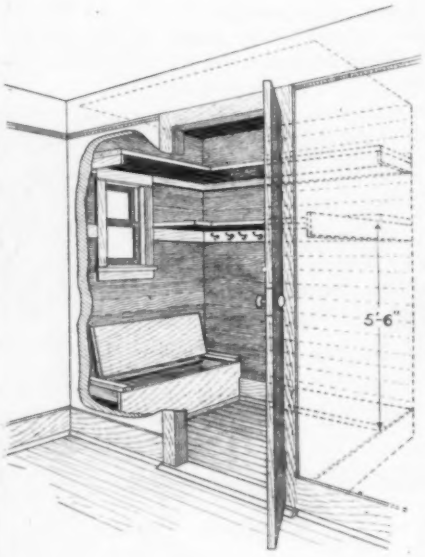


Water Dice Is New Game

Many water sports of more or less vigorous nature are in vogue at the beaches, but those who do not care to participate in these have very little left to do. A more quiet game, which will prove to be interesting as well as mildly exercising, is shown in the accompanying drawing. It is simply a game of dice played in the water. The dice are made from strips of cork, like those used for refrigerator insulation. They are about 2 in. thick and three pieces have to be glued together to make a cube side 6 in. square. The sides are then glued together to form the cube. The cork is cut with a sharp knife or with a fine-tooth saw. The required number of holes on each face are drilled about ¾ in. in diameter and about ¼ in. deep. The cube is given two or more applications of white paint and the holes are then filled in with black, each coat being allowed to dry thoroughly before the next is applied.—C. A. Champion, Detroit, Mich.

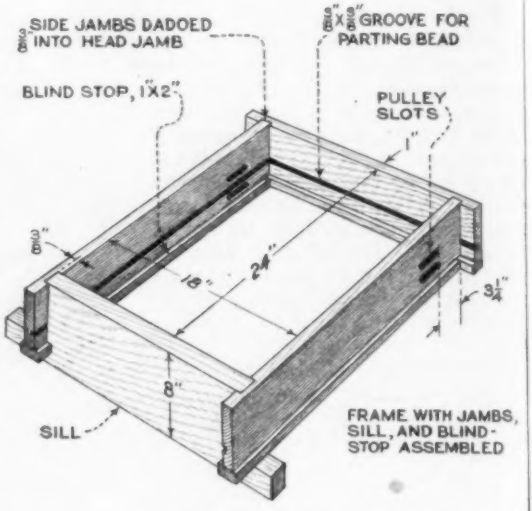
Water Dice Made of Cork Offer Interesting Game and Give Mild Form of Exercise

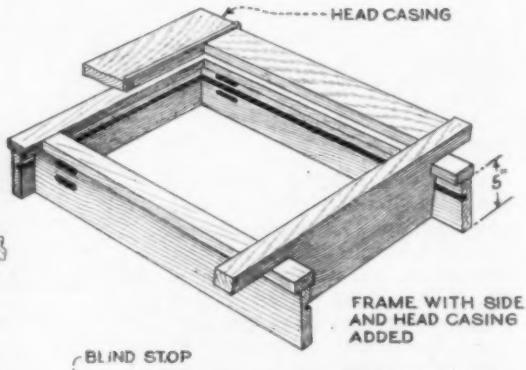
¶Hotbeds should be built and filled very early in the season; a long time before the cold spring weather has disappeared.

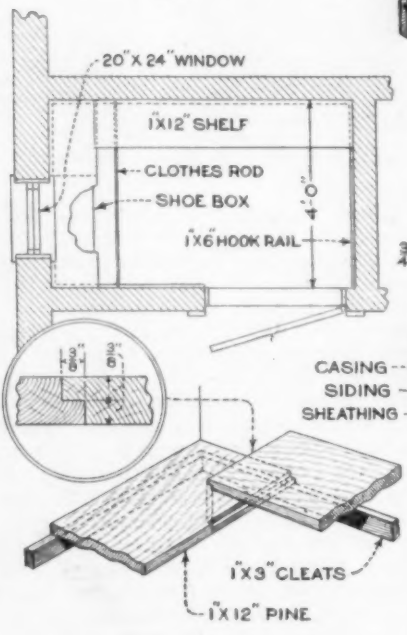


INTERIOR VIEW OF CLOSET SHOWING WINDOW, SHOE BOX AND SHELVES

Fig. 1

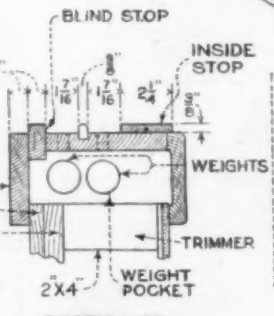




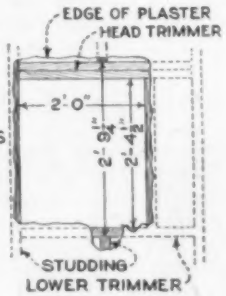


METHOD OF JOINING SHELVES THAT MEET IN A CORNER

Fig. 3



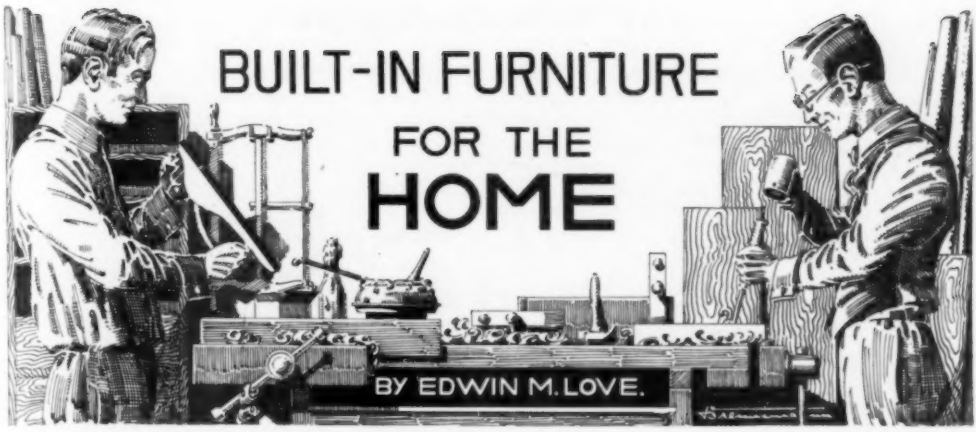
SECTION OF WEIGHT POCKET



TRIMMING OPENING

Fig. 2

General View of Closet, Detail's of Construction of Window Casing and Section of Weight Pocket; Plan of Closet and Fittings; Methods of Making Shelf Joints in Corners and of Trimming Window Opening



Part VI—Furnishing a Clothes Closet

THE ideal clothes closet is a moth-proof ventilated room with hanging space for clothes and abundant shelf room for storage. Any closet, whether plastered or not, can be easily lined with cedar. If built against an outside wall, light and ventilation are readily secured by installing a window; but if it is an inside closet, a floor vent and ceiling vent will give the circulation of air. Shelving, if necessary, can be put all around the closet above the hook rail. To estimate the amount of cedar necessary to line a given closet, multiply by 2½ the number of square feet of surface to be covered, which gives the lineal feet of stock, 6 in. wide, needed, allowing for waste. Group lengths so that the material will cut economically. Thus, 10-ft. lengths will cut sides and ends for a closet 4 by 6 ft.; but if the closet is 6½ ft. long it is better to order 8 or 12-ft. lengths for the ends, and 14-ft. lengths for the sides. Cover the ceiling first, running the boards crosswise of the joists and nailing through the faces with six-penny finish nails, since with such thin material it is impractical to blind-nail, when the nail must be long enough to penetrate the plaster before reaching the joist or studding. On the walls, make careful joints at the corners by scribing the ends of the boards; or if this seems too difficult, merely butt the joints, and after lining, cover the joints with triangular corner beads. Naturally the cedar is left unfinished, so that the odor so repellent to moths is not diminished. A very good window for a clothes closet is the 18 in. by 2-ft. double-hung. The detail of the frame, Fig. 2, gives dimensions of stock for walls of 2 by 4-in. studding, sheathed with stock ¾ in. thick, and sided with ½-in. material, where the outside casings nail over the siding. Departure from this va-

Moth-Proofing the Clothes Closet by Lining It with Cedar Is a Simple Job for the Home Craftsman

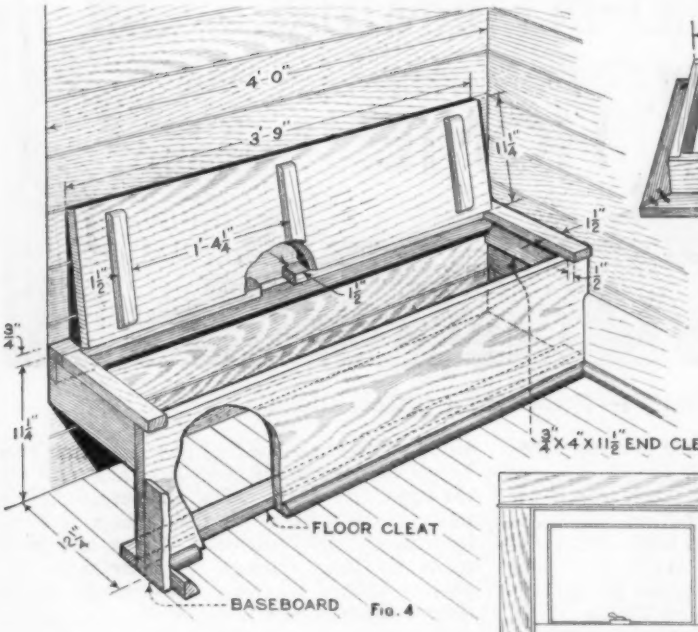
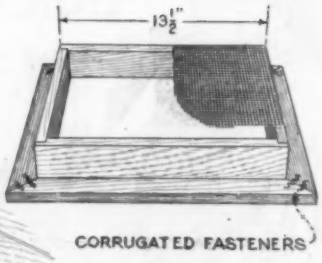


Fig. 4



CEILING VENT
Fig. 5

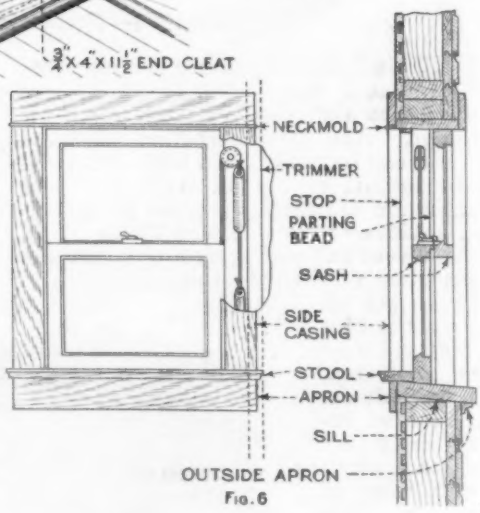


Fig. 6

Above, Construction of Shoe Box and Ventilator; Right, Section of Window When Fitted in Place

ries the width of the jamb, the sill, and the inside stop, but not the construction.

Cut two pieces of jamb stock, 2 ft. 4 in. long, and joint straight to the necessary width, beveling the edges slightly toward the pockets, to insure tight joints where seen. Square one end of each, and, measuring along the edge of the groove nearest the inside to the frame, lay off 2 ft. ⅜ in., which allows ⅜ in. for the dado in the head jamb. Set a bevel square to the slope of the other window sills in the house, and mark the dado for the sill, sloping it toward the outside. After dadoing, cut the pulley holes according to dimensions, boring out with a ⅝-in. bit and cleaning with a chisel. Nail on the blind stop, projecting it inside ½ in.

The sill must be ripped along the lugs with a bevel parallel to the jambs, and the inside edge ripped to width, unless there is as little as ¼ in. to remove, when planing will be best. In assembling, if the dadoes are a little loose, drive a chisel in the back to force the face corners tight before nailing.

Cut the top ends of the blind stop ½ in. back from the lower face of the head jamb and nail on the head stop. Case up to correspond with other outside window casings on the house, and insert the pulleys, driving a 20-penny common nail through each pair behind the jamb.

Cut the hole in the wall 2 ft. by 2 ft. 9¼ in., and trim as shown in the detail, using one stud as a side trimmer and cutting in the other between the double-head trimmer above and the single one below. The bottom of the upper header should be 1½ in. above the position of the underside of the head jamb, which is set in a line with other windows in the same wall.

In setting the frame, rest the head jamb on the end of a stick cut to the proper length, plumb the sides and level the sill, making the weight pockets of equal width, and nail through the outside casings. Wedge the sill tightly and block above the head jamb, piece in the siding where necessary, and fit the parting bead in the groove, the head going in first and the sides cutting against it.

To hang the sash, joint the edges until there is a clearance in width of ⅛ in. Notch the lip rail to fit around the parting bead, slip the sash cord through the outside pulleys, tie on a weight with a bowline knot, and make a single knot in the other end to slip into the groove and hole in the

stile, where it is secured with a four-penny finish nail driven through it. The inside sash is scribed to the sill.

Fit the stool, Fig. 6, case up, put the apron under the stool, and fit the stops, allowing enough clearance for the sash to slide easily after being painted.

If there is no chance for an outside window, make a jamb in the form of a box, 13½ in. square outside, cover the upper side with wire screen, and case the face edge with a plain band, about 2 in. wide, as in Fig. 5. Cut a suitable hole between two ceiling joists and set the frame by nailing into the joists through the casing. A floor vent is easily made by boring a number of 1-in. holes in the floor in one corner where it is not much walked on. Screen this from underneath if the foundation vents are not screened.

A good height for the hook strip is 5 ft. 6 in. from floor to upper edge. Use this rail as a cleat to support a shelf of 1 by 12-in. pine or fir; and if it is desired to continue it around the room, rabbet the end of a long shelf to fit on a corresponding shoulder on the edge of the short one, as in Fig. 3. Other shelves may be set on cleats nailed to the walls.

Across the ends, or back, wherever convenient, put a clothes rod, 1¼ in. full round. This may be made removable by resting the ends in holes bored in the hook strip, or it may be nailed solid.

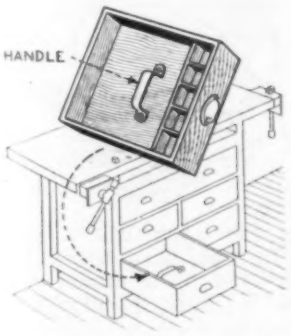
The shoe box illustrated in Fig. 4 is very convenient for keeping shoes grouped together out of sight. It is built preferably in one end, of 1 by 12-in. stock, having a hinged lid hung between end rails to prevent rubbing against the walls.

Paper Tells Baking Temperature

Correct baking temperatures in the kitchen oven can readily be ascertained with the aid of pieces of white paper. The pieces are put in the oven for five minutes and the shade of the paper then carefully noted. If it is light yellow the temperature is right for baking sponge or pound cake. If it is dark yellow the heat is sufficient for all kinds of layer cakes. The paper should be a rich, dark brown if bread and pastry are to be baked. Care should be taken not to leave the paper in the oven longer than five minutes.

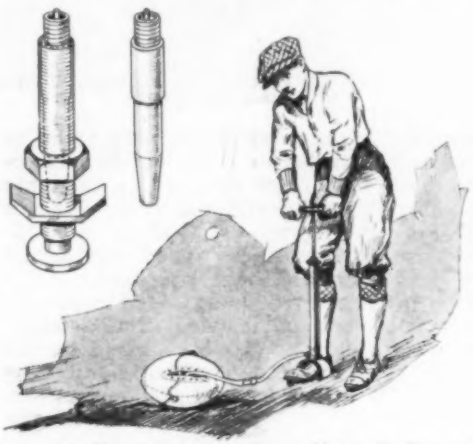
Handle Makes Tool Box of Drawer

It is often convenient to remove a tool drawer from the bench and take it to the job. To facilitate this, a handle may be attached to the bottom of the drawer, as shown in the illustration. This will save much time and makes it much easier to handle the drawer, as it gives a good grip and also balances it. In this way the advantages of a portable tool box and a drawer can be combined.



Air Valve for Football Bladder

It is usually a difficult job to inflate a football bladder with lung power and a tire pump is not convenient to use as there



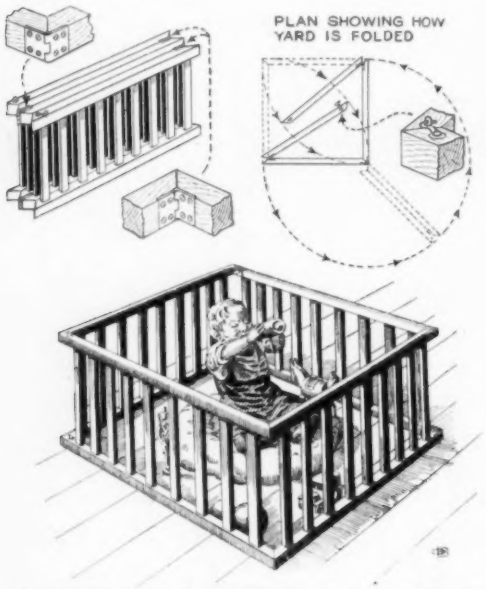
Auto Air Valve Ground to Taper Makes It Easy to Inflate Football Bladders

is no air valve to prevent the air in the bladder from coming back again. A simple remedy is to get an old tire valve and grind it down to the shape shown in the detail. The tapered end is inserted in the tube on the bladder and in a few minutes it can be pumped up to the required pressure.—J. E. Rooney, Hawthorne, New York.

¶To remove scratches from glass negatives make a thick paste of emery flour and alcohol and rub over the scratch with a piece of flannel.

Portable Baby Yard

Most children at the age when they have just learned to walk, get into mischief by pulling down ornaments around the house



Portable Yard Confines Children and Lessens Worries of Mothers and Sisters

or get in dangerous places, such as cellar steps, which causes considerable anxiety to mothers or older sisters. To eliminate this trouble the portable baby yard shown in the drawing will be found useful. It consists of four sides hinged together at three corners and held with hooks at the fourth. It can readily be folded to occupy a small space and carried around wherever needed. The details clearly show the construction and the method of fastening the parts. It can be used outdoors as well as indoors and will then prevent the youngsters from running away, which they have a habit of doing at this age.—Margaret Vogt Siddall, Moravia, N. Y.

Preventing Uneven Wear on Shoe Heels

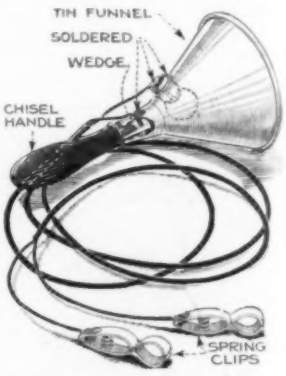
Nearly everyone has trouble with shoe heels wearing off on the outside, which makes it necessary to have them repaired frequently. To prevent this trouble, take the shoes to a repairman and have him loosen the outer layer of leather on the heel just enough to insert a small tapered piece on the outside. This makes the heel slightly higher at this point, and prevents it from wearing down so rapidly.

Enameled Ironware in the Home

Much enameled sheet steel (granite ware) is now being used for cooking, and enameled cast iron for sanitary articles such as washbasins and bathtubs. The quality of the ware can be judged somewhat by the appearance; by the absence of roughness, blisters and bubbles, bare spots, by gloss and freedom from hair cracks and peeling, but the real wearing quality cannot be determined by the housewife except by use. Enameled ware that is readily roughened by the application of diluted vinegar should be regarded with suspicion, although care should be taken to prevent contact of acids of all kinds with enameled surfaces. On no account should bathtubs and basins be cleaned with acids, but soda or alkaline cleaning compounds should always be used. A simple test of enameled ware is to apply either red or black ink to the surface and allow it to dry. Upon washing with clear water no stain should be left.

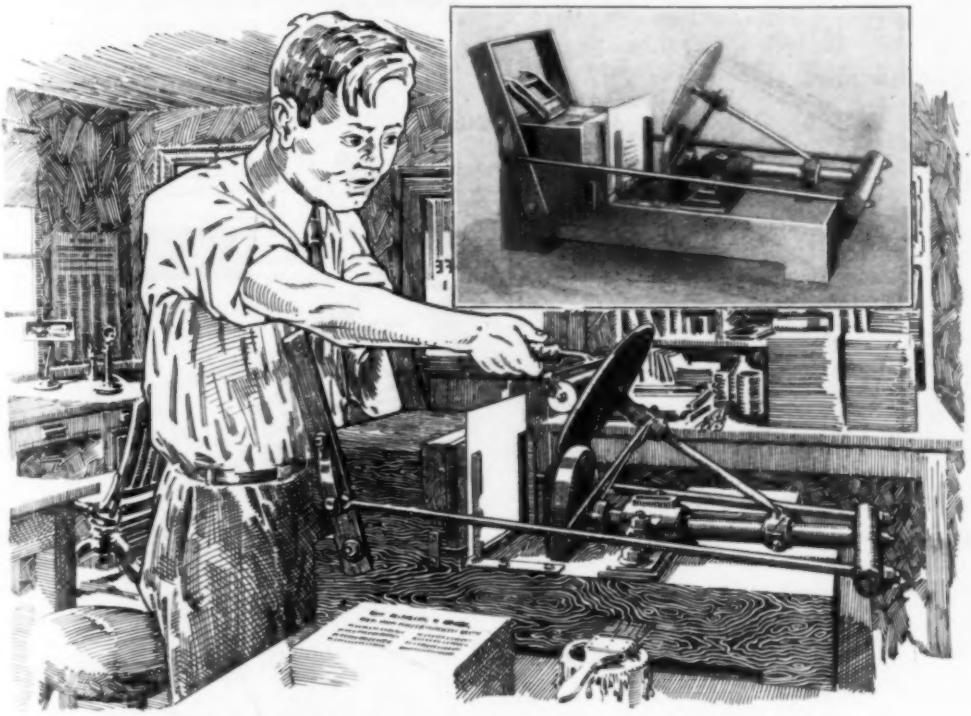
Making a Cheap Trouble Lamp

A cheap trouble lamp can be made from a 20-cp. headlight and its socket, a 5-cent tin funnel, a few feet of lampcord, two battery clips and an old chisel handle. The handle is drilled to allow the cord to pass through it, and a slit is sawed in the taper end to receive a wooden wedge, which is driven in after the handle is put into the spout of the funnel. The lamp socket is put through a hole cut in the side of the funnel and is soldered in place. After the lamp is adjusted in the socket, one end of the wire of the lampcord is soldered to the center contact and the other end to the spout of the funnel as a ground, and the clip on the other end of this wire is fastened to some bare metal part of the car, when used. The second clip is attached to the ungrounded terminal of the storage battery on the car. If the inside of the funnel is painted with white enamel, it will reflect the light much better.—F. S. Root, Fall River, Mass.



A Homemade Printing Press

By R. T. POUND



A Printing Press That Can Be Constructed in Any Home Workshop, and That Will Do as Good Work as a Press Costing Ten Times as Much

ALTHOUGH the press described in this article can be constructed of parts to be found in almost any home shop, it will do good work, and is sufficiently powerful to make a clear impression with little effort. The chase is large enough to permit the printing of letterheads, postcards, and also additions, such as a name and address, to large pieces.

The main frame or base is a piece of hardwood 2 by 8 by 21 in. Across each end of this piece, at the bottom, screw strips 2 in. square, to serve as feet and to prevent warping. At one end of the base fasten with four bolts three blocks of 2-in. wood, each 6 by 8 in. This forms a press bed which is 6 in. high and 8 in. wide. Now square up a block of 1-in. hardwood to fit the bed and fasten it temporarily with a screw at each corner. The paper to be printed is laid on this hardwood block, which, therefore, must have a plane face and also be parallel with the type. As wood may eventually warp, a piece of thick flat metal can be inserted to take the type pressure if desired.

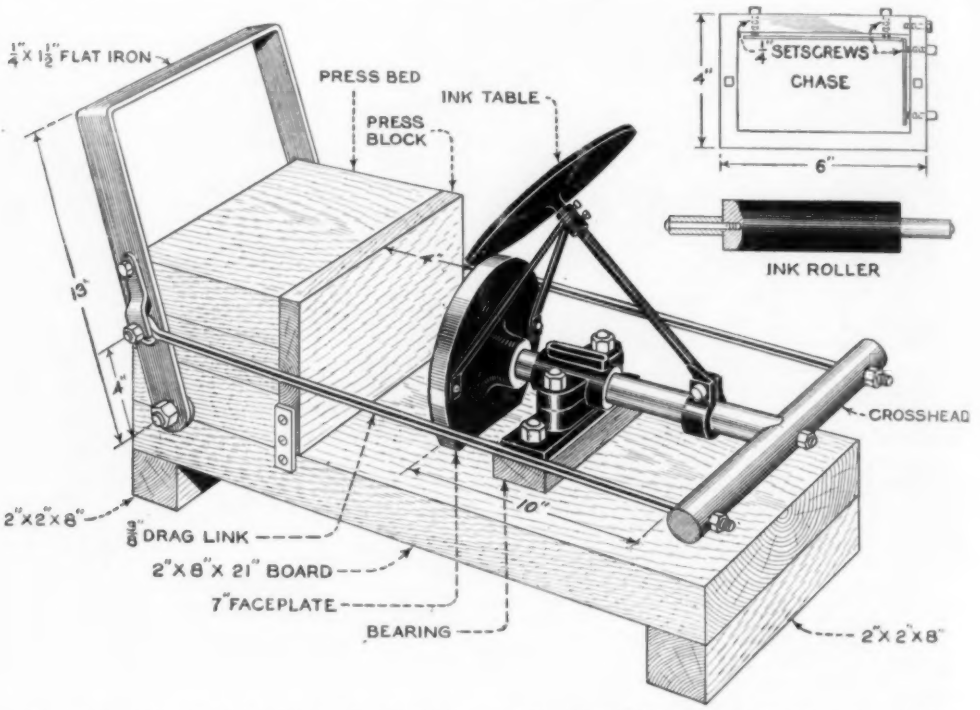
Now obtain a 7-in. faceplate, a piece of 1-in. shafting about 10 in. long, and a plain split box bearing to fit the shafting. Cut about 1½ in. from the edge of the faceplate, making a flat edge to slide along the frame. Screw or rivet the shafting into the faceplate, and then file and scrape the face to a plane surface if it is not already so. Care must be used to see that the plate face is at an angle of 90° to the shaft, otherwise trouble may be experienced when lining things up. Slip the bearing on the shaft, and block it up so that the flat edge of the faceplate just scrapes the base and the face of the plate is about 4 in. from the press block. Owing to the differing lengths of split bearings, the length of the shaft necessary may be less than that mentioned.

After finding the position in which to fasten the bearing, a piece of 1⅛-in. shafting, 12 in. long, must be obtained for a crosshead. Drill a ⅜-in. hole through the center of this, and fasten it with a ¼-in. setscrew to the end of the 1-in. shaft. This arrangement allows the crosshead to rotate slightly as the toggle drag links move down. A U-shaped piece with two legs, each 14 in. long, must be bent so that the base of the "U" is 8½ in. long,

inside measurement. The "U" is made of ¼ by 1½-in. iron and serves as the handle by which power is applied to the press. At a point 1¼ in. from the open end of each leg, drill a hole to fit 1-in. shafting, and 4 in., center to center, from this first hole bore another hole in each leg and thread it to take a ½-in. stud; 1½ in. from the end of the wooden base bore a hole through the joint between the base and press bed to take a 1-in. shaft with a good bearing fit. Now straddle the U-shaped handle over the press bed, insert a 10-in. length of 1-in. shafting through the holes in the legs and the hole in the base, and fasten the handle to the shafting.

The two drag links are made of ⅜-in. round iron, threaded on one end and with an eye to fit a ½-in. stud on the other end. The ends of the crosshead are bored and threaded to take these rods. Screw the drag links into the crosshead, and then fasten the eyes to the handle with ½-in. studs.

By screwing the drag links in or out, the pressure on the type can be nicely adjusted. If no changes have been made in the other dimensions, these drag links will be 20 in. long from the center of the stud to the center of the crosshead. By threading the links for a generous distance in-



Constructional Details of the Homemade Printing Press; Below, Assembly of Press, with Dimensions; Above, Detail of Chase and Ink Roller

accuracies in construction can be corrected here.

The press is now ready for the chase. This is bent of ⅝-in. square iron, to form a rectangle measuring 4 by 6 in. outside. The joint is made with a ¼-in. setscrew, or it may be welded. The inside of the chase must be filed square. One side and one end of the edge of the chase should be drilled and tapped for ¼-in. setscrews, two on each edge. These screws bear against metal bars which slide within the chase and thus lock the type in place. To fasten the chase to the faceplate a ¼-in. setscrew is passed through each side of the chase into the faceplate, or through the plate into the chase if handier.

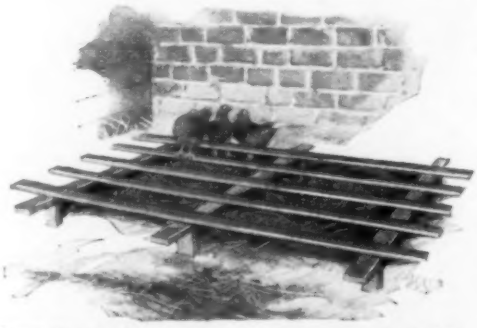
To test the press, some type should be set up and locked in the chase, which should then be fastened to the plate. A discarded phonograph turntable, with the felt removed, makes a good ink table. Ink the type with the roller as you stand facing the plate. Place several sheets of paper against the press bed and bear down on the handle. This moves the faceplate against the press bed. It will probably be found that the block against which the

type bears needs shims behind it to aline it with the type. When this adjustment has been made, fasten the block solidly with the four screws provided. It is also possible that, although the type apparently bears evenly on the block, there are one or two spots where the impression is faint. "Build up" these spots by pasting pieces of gummed paper under them until the impression is even. Cardboard and blotting paper may be needed behind the paper being printed, or the drag links may require adjustment. The pressure necessary for a good impression runs as high as 600 lb. per square inch in the case of fine type.

Once the press has been adjusted, it will be a help to mount the ink table at the back of the faceplate, as shown in the illustrations. Guides on the chase will help the ink roller to do its duty. Paper fingers can be hinged to the frame, and automatically operated by a cord from the crosshead passing over a pulley on the end of the frame and then to the fingers. Adjustable stops will be handy if a large quantity of printing is to be done.

Teaching Young Chicks to Roost

Young chicks like to keep up their first instinct of huddling together in a corner to sleep and it is therefore rather difficult to teach them to roost. Realizing this difficulty, a poultryman built some roosts in the corner of the chick house, which were raised only 6 in. above the ground so that the chicks could easily hop onto them. Later, when they are moved to other quarters with regular roosts, they



Small Roosts, About 6 In. High, Train Young Chicks to Roost

know what to do. These roosts are similar to the regular kind, but are a trifle smaller to fit the chicks' feet. Each unit is light so that it can readily be removed to facilitate cleaning.

A Barrel Canoe for Bathers

Riding the surf behind a speedy motorboat belongs to the thrills of many seashore enthusiasts, but the more timid pleasure seekers usually find enough

Barrel Canoes for Bathers Are Practically Non-Sinkable and Provide Good Sport

"kick" in the conventional forms of water sport such as rowboating and canoeing. However, rowboats and canoes are not always available, especially at some small inland lakes, and in such cases a barrel canoe of the kind shown in the drawing is a good substitute.

It consists of half a barrel, cut lengthwise, and an automobile inner tube stretched around it, as shown; these items can be obtained almost anywhere at practically no cost. Each hoop is securely nailed or screwed to the staves before sawing so that the barrel will not collapse when cut through. The ends are then cleated and all screws or nails projecting on the inside cut off and filed smooth. The inner tube is pulled down a few inches below the gunwale and inflated, which will make the craft almost noncapsizable and unsinkable. By sitting in the bottom and paddling, the boat can be propelled along at a fairly good speed, but if the user stands up the boat will have a tendency to rock, and this adds enjoyment as he must then balance it, which is a more or less ticklish feat.

¶ Frozen potatoes should be placed in a dark place until thawed.

Fish-Pole Clamp for Boat Fishing

When using more than one fish pole it is, of course, impossible to hold them all at the same time, or to hold any when rowing, and they have to be laid down. It often happens that the hook is caught in weeds while rowing or drifting and the pole is pulled overboard, or a big fish jerks it into the water. To avoid losing the pole, the clamp shown in the drawing has proved useful. It consists of an 8-in. strip of flat, spring metal, preferably brass, about 1 in. wide and bent to the shape indicated. It is doubled and two holes are drilled through it for a screw or bolt, which is used to tighten the clamp on the handle of the pole. The legs of the clamp are bent outwards slightly so that they can readily be pushed over the gunwale of a rowboat. Poles provided with such a clamp can be left without attention as they cannot be pulled into the water very easily.—L. B. Robbins, Harwich, Mass.

Electric-Cord Troubles

Much of the trouble experienced with electric appliances is due to improper care of the cord. Do not allow the cord to become badly frayed, and avoid sharp kinks and twists. It is a common occurrence that individual wires of the stranded conductor forming the cord become broken inside the insulation; do not, therefore, tie tight knots in electric cords, do not pull them taut continuously over sharp corners and do not pull them tight over nails in hanging them up.

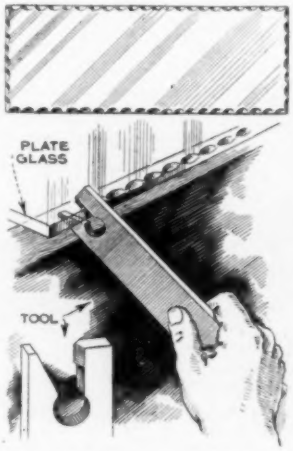
Two nails or hooks, placed about 1 in. apart, so that the cord may be hung up by the attachment at the end will be found satisfactory for keeping extra cords. Vacuum-cleaner cords should be coiled loosely like a lariat and hung over one hook on the appliance only. The lower hook should not be used, as this encourages the tendency to wind the coil tightly, and shortens its life. If trouble is suspected, take the cord to an electrical dealer to be fixed at once.

Drying Prints Quickly

One day I found it necessary to dry some photographic prints quickly, which could not be done by the old method of laying them on a sheet of cheesecloth. I took a piece of plate glass, of which the dimensions were about 1 in. less than the size of the oven in the kitchen range, and laid the prints on this face down, rolling them with a print roller to press most of the water out and make them lie flat. The glass with the prints was then laid in the oven of the range, after making sure that the oven was not hot enough to scorch the paper. In twenty minutes the prints were thoroughly dry and the same method was thereafter used with equal success.—Burton F. Moore, Wendell, Idaho.

Plate-Glass Scalloping Tool

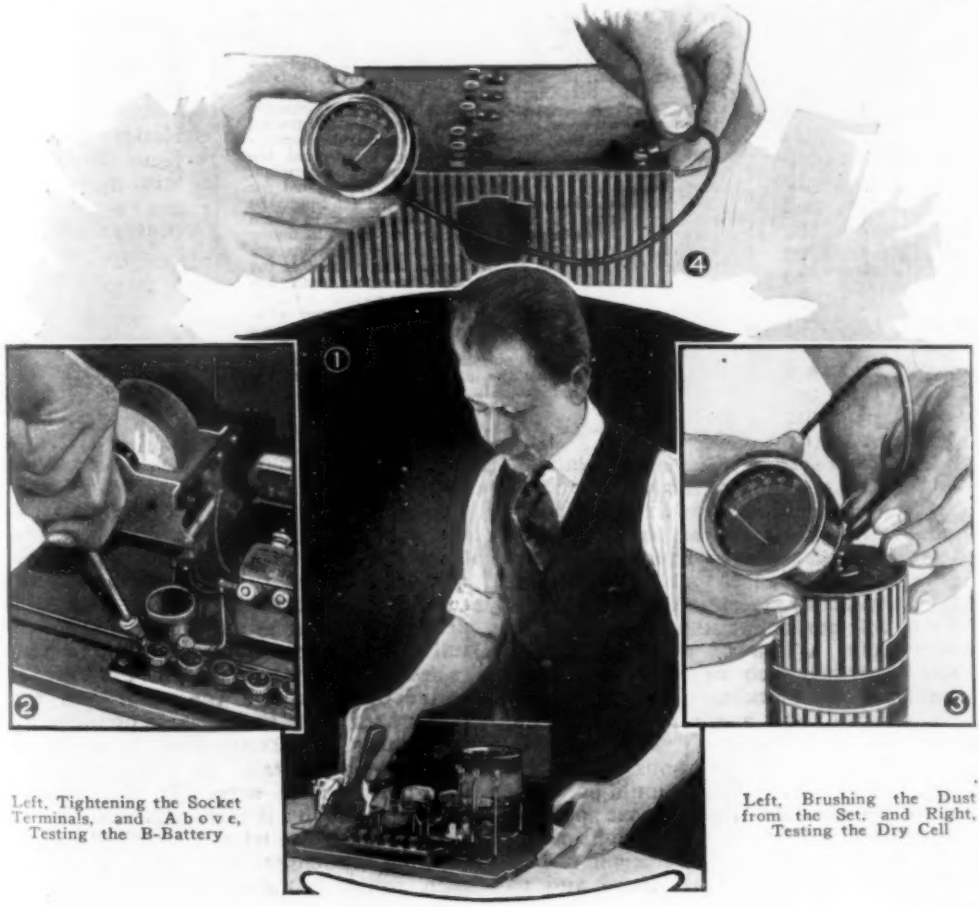
In our November issue of 1924, on page 862, a tool was described for scalloping plate glass. Unfortunately, an error crept in the drawing of this tool, and also in the accompanying description of it, and the tool would be rather impractical. In the drawing referred to the tool was shown to have two teeth. This would make large and irregular chips, when used on the plate glass which, of course, is not desired. The tool should have only one tooth, as shown in this drawing, so that the glass will chip off neatly and evenly, resulting in a good scalloping job.



Getting the Best from Your Set

Little Things That Make the Set Perform as It Did When It Was New

KEEPING the radio receiver operating efficiently is a simple matter, but like any other piece of electrical mechanism, the set demands a certain amount of attention at regular periods. This is true not only of a set the owner is proud of because he built it himself, but also of the manufactured apparatus. The owner perhaps has noticed that his set seemed to work better when it was new; this is usually not all fancy, but is very natural. When it is new, the batteries are fresh, the



Left, Tightening the Socket Terminals, and Above, Testing the B-Battery

Left, Brushing the Dust from the Set, and Right, Testing the Dry Cell

contacts are clean, connections tight, the instruments are free from dust, bushings have not had time to wear and the receiver is efficient in every way. This is the condition that must be maintained if it is to continue to give satisfaction.

The first indication of trouble usually is decreased volume, or lack of clear tone. The operator is tempted to blame the weather, or static, or even speak unkindly of the broadcasting station, when the trouble really lies in his own set. One of the greatest trouble makers is dust, which finds its way into all types of cabinets and is an enemy to good reception; it creeps between the plates of variable condensers and moving contacts, and, if allowed to accumulate, will eventually short the condensers and spoil the contacts. To "service" a receiver, first remove the tubes and place them out of danger of accident; disconnect the batteries, marking leads with little cardboard tags to insure that they will be connected again properly, and then remove the set from the cabinet. The first thing to do is to use a small camel's-hair brush to clean off the dust accumulated on the surface. Any dust that has settled between the plates of the variable condensers must be removed also; this can be done with an ordinary pipe cleaner, or a small brush supplied by the radio dealers for this purpose. Dust between the condenser plates often causes noises similar to static. Wipe and scrape all movable contacts and wiping joints, as many times a film of grease forms at these points, which in time will cause trouble. Socket binding posts should also be tightened, and a special tool in the form of a socket wrench facilitates this, although it can be accomplished with a small pair of pliers. Care should be taken not to use so much pressure that soldered connections will be broken; a slight movement of the wrist will be sufficient to find out if the knurled nut is loose and to tighten it. After the socket posts have been tightened, see that all the spring clips in the socket are raised sufficiently to make good contact with the prongs on the base of the tubes; if not, use a buttonhook in the manner shown in one of the illustrations to raise the contacts. If the socket is of the side-spring type, see that these springs are in the correct position to make good contact. The prongs on the base of the tube should be cleaned several times a year. Many times this will eliminate circuit noises that are very difficult to trace, and good contact with the tube in the socket is absolutely necessary if highest efficiency is to be obtained. Clean the ends of these prongs with a small nail file or fine sandpaper. Handle the tubes with care, as they are fragile, and often a slight knock on the table is sufficient to break the filament. This is especially true of the dry-cell type of tubes.

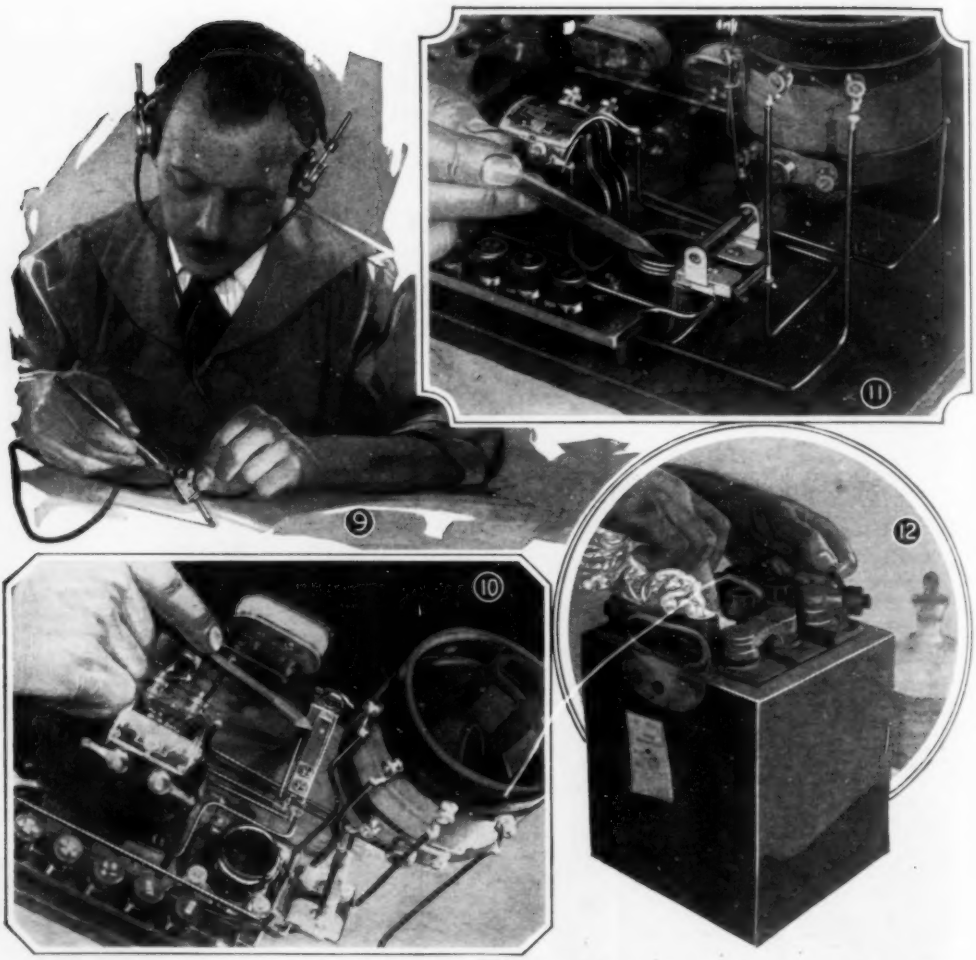
Examine the blades on the jacks to ascertain that they make proper contact, and that the contact points are free from dust and soldering flux. Jacks are poor things at best in radio circuits, and must be kept in good condition at all times. Place a plug in the jack and note if proper contact is made in opening and closing the circuit. Grid-leak clips must be clean and so bent that they grip the leak cartridge tightly; also make sure that the machine-screw and soldered connections to the grid condenser and leak are secure. After carefully going over all soldered connections to see that everything is tight, examine the connection between the rotor and stationary plates of the variable condensers; frequently this connection is made by means of a "pigtail," or short length of flexible stranded wire. If this wire is frayed, renew it; if merely twisted, rotate the dial until the wire is uncoiled. Most variable condensers have stops to prevent such trouble, but some unfortunately have

Two hours' test of the three-tube Cockaday receiver described in the April issue of Popular Mechanics brought in twenty distant stations, despite adverse conditions, including severe static, unusually marked fading, and the fact that the test was made in a steel reinforced apartment hotel in the heart of Chicago.

The stations heard included two in Kansas City, Mo., one in Dallas, Tex., two in Cincinnati, Ohio, two in Pittsburgh, Pa., one in Schenectady, N. Y., Jefferson City, Mo., Troy, N. Y., Cleveland, Ohio, Hot Springs, Ark., Shenandoah, Iowa, Davenport, Iowa, and Los Angeles, Calif., as well as five Illinois towns outside of Chicago. Stations as widely separated as Kansas City, Shenandoah and East Pittsburgh were brought in on the loud speaker with good volume. No ground connection was used during the test, an inside counterpoise of sixty feet of bell wire, strung around the picture molding, being attached to the ground terminal of the receiver. The counterpoise was substituted for the ground connection in order that the set might be switched over at will to a B-battery eliminator, in which case the lighting-circuit connection to the eliminator becomes a ground. With ordinary dry batteries the counterpoise gave the same distance and volume as the original ground, while with the eliminator both distance and volume were increased. The outside aerial in both cases consisted of 94 ft. of enameled-copper wire. Pittsburgh, Cincinnati, Schenectady and Hot Springs could be heard clearly on two tubes, while Davenport, one of the Cincinnati stations and the five Illinois broadcasters all worked the loud speaker on two tubes. —J. E. Miller, Chicago, Ill.

Fig. 5, Springing Socket Contacts; Fig. 6, Cleaning Condenser; Fig. 7, Testing Storage Battery and Fig. 8, Cleaning Prongs on Tube Base

not. A well-soldered connection to the shaft of the condenser is absolutely necessary with this pigtail connection. Some condensers have a wiping contact and this must have attention; wipe it carefully to remove any trace of grease, and, if necessary, tighten the spring. While working on the condensers, it will be best to see that the dial has not slipped on the shaft of the condenser. If this has happened, it will account for any discrepancy that may have been noticed in logging stations. For example, when first logged the stations would come in regularly at certain points; then later, for no apparent reason, these same stations required a different



Upper Left, Testing Plug Contacts; Upper Right, Grid-Leak and Condenser Contacts; Lower Left, Contacts on Jack, and Lower Right, Cleaning Top of Storage Battery

dial setting. If this is the case, release the little setscrew in the dial to free the latter on the shaft. Now place the finger on the rotor plates and move them until they are in the "all-in" position, then set the pointer on the dial to the maximum reading on the dial scale, and tighten the setscrew so that the dial cannot move on the shaft, being careful not to change the position of the pointer in relation to the position of the movable plates. The dials will then log the stations in the proper place again.

See that the rheostat shafts are gripped tightly in the knobs, and that the pointer is in the proper position to indicate the off position. There is a setscrew on the pointer knob to fasten the latter to the shaft; this can be released and the knob readjusted to the right position, if necessary. In some cases this screw is in a collar at the rear of the rheostat assembly, instead of in the knob itself. If the collar is loose, it will be necessary to use pressure to fit it tightly against the blade and lock washer, or star-spring washer, so that the blade of the rheostat will make a good wiping contact on the resistance winding. Finally, examine all binding posts on the set, and make sure that the nuts on the underside are tight and making good contact with the soldering lugs on the wiring.

We have now finished with the internal assembly of the instrument, and are ready to replace the set in the cabinet. Before connecting the A and B-battery wires, test the batteries. Use a small d.-c. voltmeter for this purpose; this should have a scale reading from 0 to 50 volts, and can be ob-

tained from any dealer in radio supplies for about $1.50; every owner of a radio receiver should have one. A flexible cord with a metal terminal and another terminal on the case of the instrument are used in making the connections for the test. Hold the terminals on the voltmeter in the position shown in the illustration just long enough to get a reading. Never use an ammeter for testing B-batteries; the important thing for the operator to know is the voltage that the battery will deliver to the plate of the tube. Each 22½-volt unit should test not lower than 22.5 volts in a fresh battery, and when this reading falls to 17 volts, the battery should be discarded. Never use old batteries as boosters for fresh ones. The old batteries add resistance to the circuit and soon render the good batteries inefficient, besides introducing noises in the set. If dry cells are used for A-batteries, as in the case of the UV-199 and C-299 tubes, these cells are tested in the same manner. Whenever the working voltage of the A-battery is below the rated tube-filament voltage, the cells are no longer useful for radio A-battery service, and must be replaced. The first sign of dying A-battery cells is the falling off in volume in the receiver. Diagrams for connecting the A-batteries for the number and type of tube used are supplied by the maker or designer of the instrument, so we need not go into that detail here, except for a word of caution: Be sure to hook up these batteries in exactly the same manner as before they were disconnected. The wiring for A-batteries should be heavy copper wire, to reduce the energy loss which takes place in small wires. If a storage A-battery is used, all connections should be freed of corrosion. If battery clips are used, see that they are clean and make good contact on the battery terminals. The positive terminal is indicated either with a cross or the letter P, the negative terminal by a dash or the letter N. If you find the positive terminal of the battery badly corroded, clean it carefully and cover it with a coating of vaseline; this will prevent further corrosion.

Remove all electrolyte spray from the top of the battery with a cloth moistened with a weak solution of ammonia. Care should be taken not to let any of the battery solution come in contact with clothing or rugs. It is a good plan to keep the storage battery on a rubber mat or glass plate. The storage battery should be tested with an instrument known as a hydrometer, which can be obtained from any battery or radio dealer for about 75 cents. The operator should provide a 1-qt. wide-mouth bottle in which to keep the hydrometer, and a supply of distilled water. Never allow the water level in the cells to fall below the plates, but keep the level by adding distilled water, at least ¼ in. above them. The hydrometer consists of a glass tube or barrel with a rubber bulb at the top, a rubber tube or nozzle at the bottom, and a weighted float inside, marked with graduations on the neck. The graduations usually run from 1.300 to 1.100; the decimal, however, is often omitted on the scale. To test the storage battery, unscrew the caps on the battery cells, and insert the nozzle of the hydrometer into the electrolyte in the manner shown in the illustration. Compress and release the bulb at the top several times to draw the electrolyte up into the instrument, then withdraw the nozzle. The

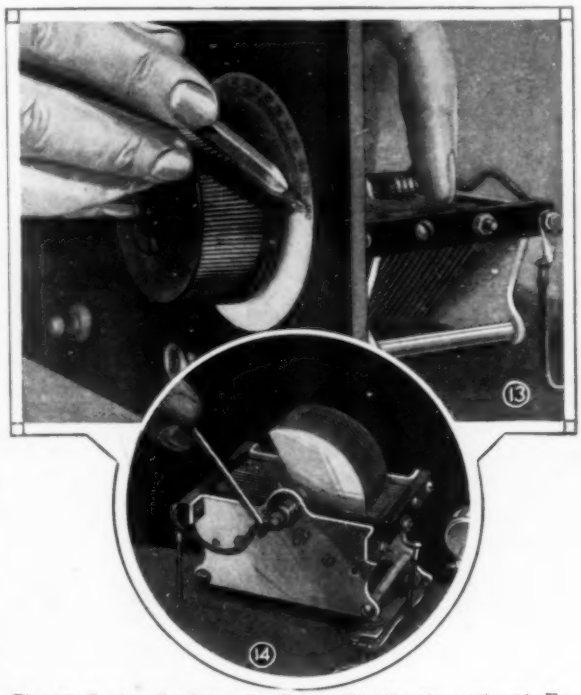


Fig. 13, Setting Condenser for Proper Dial Reading; Fig. 14, Examining Pigtail Connection on Condenser

barrel of the instrument should now be about half full of the solution and the float will ride at a depth depending on the amount of charge. Hold the barrel vertically so that the float will not touch the sides of the glass tube. When the float is at rest, observe the point on the scale reached by the liquid level. It will be found that the specific gravity of the fully charged cell will vary with the make and age of the battery, the full-charge point ranging all the way from 1.275 to 1.300. An old battery will show a lower specific gravity than a new one, so that a reading of 1.250 to 1.275 may mean a full charge in an old one. Never permit the reading to fall below 1.180 before recharging the battery. Replace the electrolyte, after the reading has been taken, in the same cell. Be sure to test each cell in a battery, as one may consistently read lower than the others, and this should be attended to by a battery-repair man. Clean the hydrometer with clear water before laying it aside in the bottle, as the solution will quickly ruin the rubber connections. It is a good idea to have a small light near the battery so that the test can be made easily and the level of the electrolyte determined without guesswork, as is often the case when the storage battery is located in an unhandy position.

Connecting Radio Dry Cell Batteries

There are several tubes on the market of different voltages, and the novice is often perplexed just how to connect the

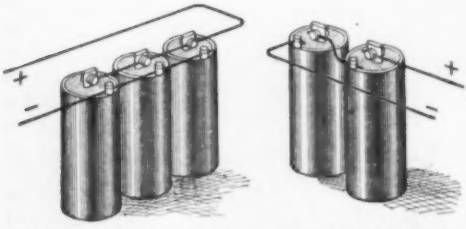


Fig. 1 3 DRY CELLS IN PARALLEL, 1½ VOLTS

Fig. 2 2 DRY CELLS IN SERIES, 3 VOLTS

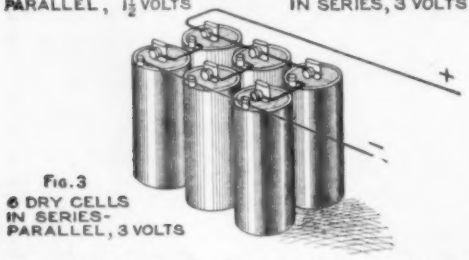


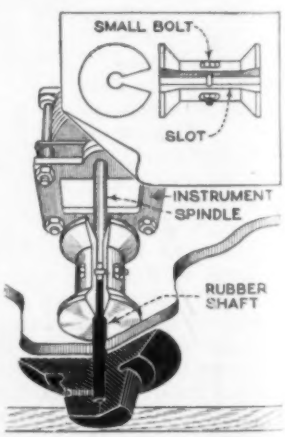
Fig. 3 6 DRY CELLS IN SERIES-PARALLEL, 3 VOLTS

Three Methods of Connecting Dry Cells to Suit Tubes of Different Voltages

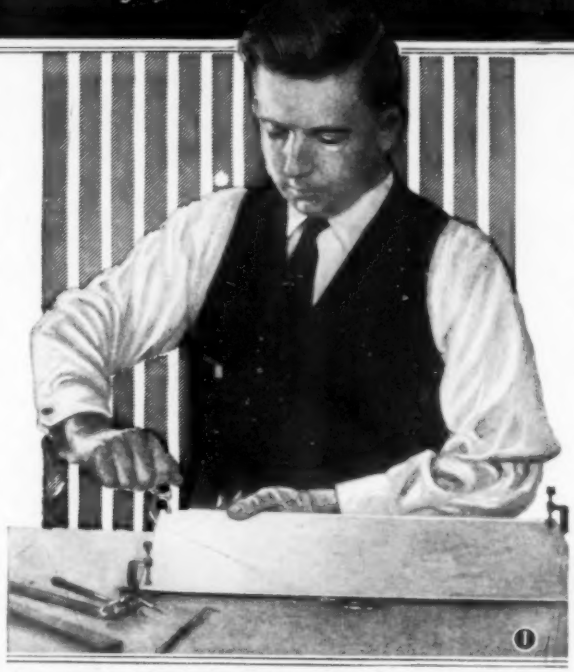
dry cells to suit the tubes. The WD-11 and 12 tubes are 1½-volt tubes, and operate on one or more dry cells, one cell being usually provided for each tube. If two or more cells are used for more than one tube, they are connected in parallel, as shown in Fig. 1. No matter how many dry cells are connected together in this way, the total voltage always remains 1½. For 3-volt tubes, as UV-199 and C-299, the required voltage is obtained by connecting two dry cells in series, as shown in Fig. 2. With this arrangement the positive of one cell is connected to the negative of the other. When two or more 3-volt tubes are used, it is good practice to use two dry cells for each tube, connecting them in series-parallel, as shown in Fig. 3. This gives 3 volts and a maximum amperage. A higher voltage than that for which a tube is designed should never be used, and the filaments should never be burned brighter than needed for good results.

Improvising a Shaft Extension

A spool can be used to form a collar on any instrument shaft where an extension is required. A tapering slot is cut lengthwise in the spool, as shown in the upper illustration; a hole is then drilled at right angles to the axis of the slot to admit a small bolt or machine screw. Wood, fiber or rubber rod, ¼ in. in diameter, can be used for the extension spindle. The shaft of the condenser or other instrument to be extended is then inserted in the spool, and the length of rod in the other end of the spool. The bolt or machine screw is then tightened and the extended assembly is ready to slip through the panel. After the dial is adjusted, the unit is ready for use. This places the instrument farther from the panel, eliminating body capacity.



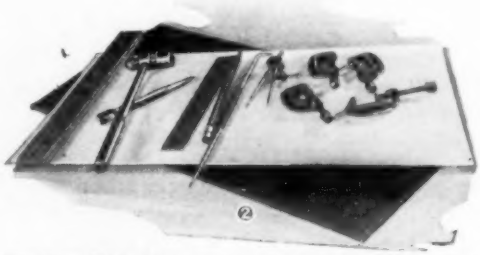
How To Lay Out And Drill Radio Panels



Fastening the Template to the Panel by Means of Small Clamps Before It Is Laid Out

MARKING out radio panels in preparation for drilling is a simple job, but, like every other mechanical task, there is a right and a wrong way to do it. In the case of radio panels, there are several methods of laying them out and marking them, any of which will give good results in the hands of an expert, or one accustomed to the job. The method described in this article, however, is the one that has been found by Popular Mechanics radio laboratory to be the simplest for the amateur, and to produce uniformly good results wherever recommended; for this reason it is the only one considered.

While we have found radio fans that can do a good job of laying out panels without any more elaborate equipment than an old 2-ft. rule, and an ice pick to serve as a scriber, it is a fact that the job is made much easier by the use of proper tools, which are neither numerous nor expensive. Four small C-clamps, a small hammer, a prick punch, a small pair of machinist's dividers, all of which can be obtained in the ten-cent store, a rule and a lead pencil are all the tools necessary.



The Few Tools Necessary for Laying Out Panels, Together with the Cardboard Template

If a 6-in. steel scale is available, it will be found handier for many of the measurements than the rule, but it is not essential. In addition to the tools, a sheet of fairly heavy cardboard is necessary. Bristol board is ideal for the purpose, but if this is not at hand or cannot be obtained easily, any kind of cardboard that will lie flat and show a pencil mark distinctly will serve very well. The board must be cut to the exact size of the panel to be laid out.

Look over the panel and select the better side for the front. Hard-rubber panels are usually stamped on one side with the name of the maker, and this determines at once that this side will be the back. On other panels, the side to select is the one that has the better finish, or shows the fewest abrasion marks. Of course, if one is using a "mahoganized" panel there is only one side to select for the front. Now fasten the cut sheet of card or bristol board to the front side of the panel by means of the little C-clamps, as shown in Fig. 1, taking care that it lies flat and that the edges are even with the edges of the panel. This gives a surface corre-

853

sponding exactly to the panel, on which the location of the various holes may be laid out in pencil as shown in Fig. 3. A template of this kind should always be employed, as mistakes will happen, and it is easier to rub out a few pencil marks on a piece of cardboard than it is to determine which of a number of scribed lines on the surface of the panel itself are the correct ones. It is assumed that the reader is laying out his panel from a diagram; the layout of an original design will be treated later. After the location of all the holes has been marked by means of cross lines measured from the edges or center of the panel, the centers of all the holes are marked by means of the prick punch, as in Fig. 4, holding the punch vertically, and striking it hard enough to force the point of the punch through the cardboard and into the surface of the panel. The sizes of all the holes should then be marked on the panel template, for convenience, and the template removed.

Making a Rough Layout of the Instrument Dials on the Front of the Panel

The marking of the screw holes for mounting condensers presents a problem when a template is not furnished by the manufacturer. There is a very good tool made for this purpose, but in the absence of this, a template may be made as shown in Fig. 5. Take a square of card or bristol board, and cut a small hole in it that will be a tight fit over the shaft of the condenser. Press it down until it is in contact with the frame of the instrument, and feel for the holes with the point of the punch. When found, press the point through the cardboard into the holes. Now, when the hole for the condenser shaft has been drilled in the panel, the shaft can be put in place from the back, the template slipped over it again, as in Fig. 6, and the location of the mounting holes marked easily, taking care, of course, that they are marked so that the condenser will be in the proper position when mounted. The shaft hole should be a snug fit for this operation, but should be reamed out afterward to clear the shaft by at least 1/32 inch.

Drills for radio work should be selected with as much care as for drilling metal. Cheap drills will not remain sharp, and when dull, will increase the tendency to chip the edges of the holes. Get good drills and keep them sharp. Never drill a panel without supporting it on a block of soft wood with a flat surface. If this precaution is taken, and the drills are sharp, there will be little or no chipping of the edges of the holes at the back. Fig. 7 shows how the drilling is done on a good drilling block. It has been found that with hard rubber it is not important from which side of the panel the drilling is done; with bakelite or formica, however, there is a slight tendency for the holes to chip around the edges at the back. In general, therefore, it is safest to drill from the front of the panel, and then if there is any slight chipping around the edges of large holes it will be at the back where it will not mar the appearance of the set. It is a good rule to drill all holes with a small drill first, as there is not so much tendency to "run off" with a small drill, and chipping by the larger drill used afterward is less likely to occur. For holes larger than 5/16 in., it is good policy to drill first with a 1/4-in. drill and then ream the hole to size as in Fig. 9. With a good reamer, there will be no chipping of the edges of the holes.

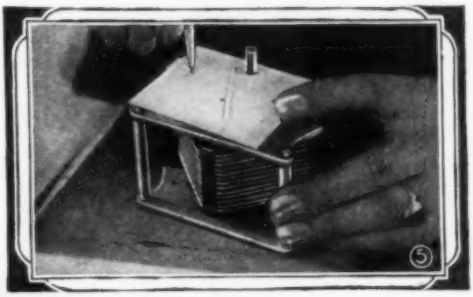
When countersinking, the operation shown in Fig. 8, be careful to see that the drill is held vertically. This operation

may be done with the panel held in the vise, if desired. The only precaution to be observed, besides the foregoing, is to see that the countersink is neither too deep nor too shallow. In the upper part of Fig. 12 is shown the effect of countersinks made too shallow and too deep. In one case the screw projects too far; in the other, the countersink shows around the edge of the screw head. It pays in appearance to be careful to get the countersinks of the proper depth, either with oval-head screws, like the examples shown, or with flat-head screws.

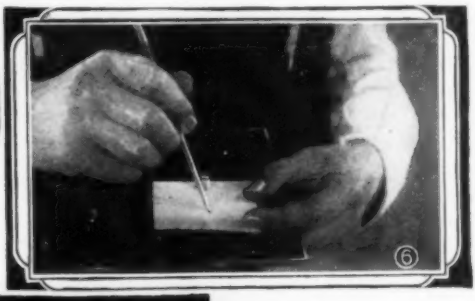
When the reader is laying out a panel "on his own," there are one or two points that are not apparent at first sight, and that may spoil the appearance of the set if not observed. The first thing to do is to lay the panel down on a table and spread the various dials on it, shifting them until a pleasing layout is secured. Jot down on a rough sketch the position of the dials, and then refer to the circuit diagram. Go over it carefully and see if the layout will give the shortest possible leads between the instruments on the panel and those on the baseboard. It may necessitate several trials until a compromise between good appearance and efficient wiring is obtained. When this is done, a cardboard template may be se-

Laying Out the Position of the Instruments on the Template

Marking the Panel through the Template with the Center Punch



Punching Template to Fit the Holes in a Variable Condenser



Using the Template Made as Above to Mark the Holes in the Panel; Left, Drilling the Panel with a Hand Drill

cured to the panel and the actual layout made on it. One point that many amateurs overlook is that the edges of the panel slide in grooves in the cabinet. The depth of the grooves, which is usually 3/16 in., as in Fig. 10, should be measured and lines representing them marked on the template. These lines are then to be taken as representing the edges of the panel for the purpose of the layout.

Countersinking and Reaming Panels; Correct and Incorrect Countersinks, and Method of Laying Out New Designs

It is best when laying out the panel, in a symmetrical design, to forget the edges of the panel and to lay off all the holes from the center. In Fig. 11, for example, we have a 16-in. panel, and the center line B can be marked 8 in. from the end, as shown. As the cabinet groove is 3/16 in. deep, however, line D, which may be the center line for a condenser or other instrument, would not be laid off 4 in. from the center B, but 3 29/32 in. from it. This would be the layout if the instrument on line D was the only one to be placed on this side of the center of the panel. If, however, there is a rheostat knob at C, and another knob at E, the center of the condenser would have to be shifted from D to F, in order to make the panel appear well-balanced. The matter of balance in the panel is an important one, as upon it depends the appearance of the set when completed. However, efficiency must not be sacrificed for appearance, and the thing of first importance is "how will the set operate?" In most cases, however, the builder will find that there is some arrangement of the instruments that will not only be efficient, from the wiring standpoint, but that will lend itself also to the production of a well-balanced panel.

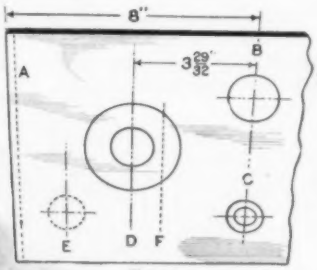


Fig. 11

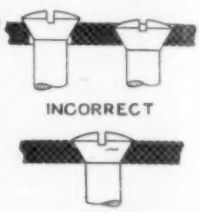


Fig. 12

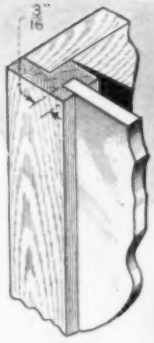


Fig. 10

Regulating Heat of Electric Soldering Irons

Many radio fans have had considerable trouble in making the heating elements of electric irons stand up any appreciable time. The trouble probably has been that it is too much trouble to turn off the juice as often as necessary, the reason being that the iron takes too much time to reheat. This trouble can be avoided nicely if the fan will secure a "dimlite" socket, obtainable at any electrical store. The fitting is mounted above the workbench in any standard socket. With the pull cords lengthened to be within easy reach of the operator, all the trouble of a cold iron will be done away with. The iron will remain sufficiently warm to run up to full heat in a few seconds and no time will be lost, neither will it be burnt out. The cost of this fitting is slight compared with that of replacing soldering irons for radio work. —L. H. Georger, Buffalo, N. Y.

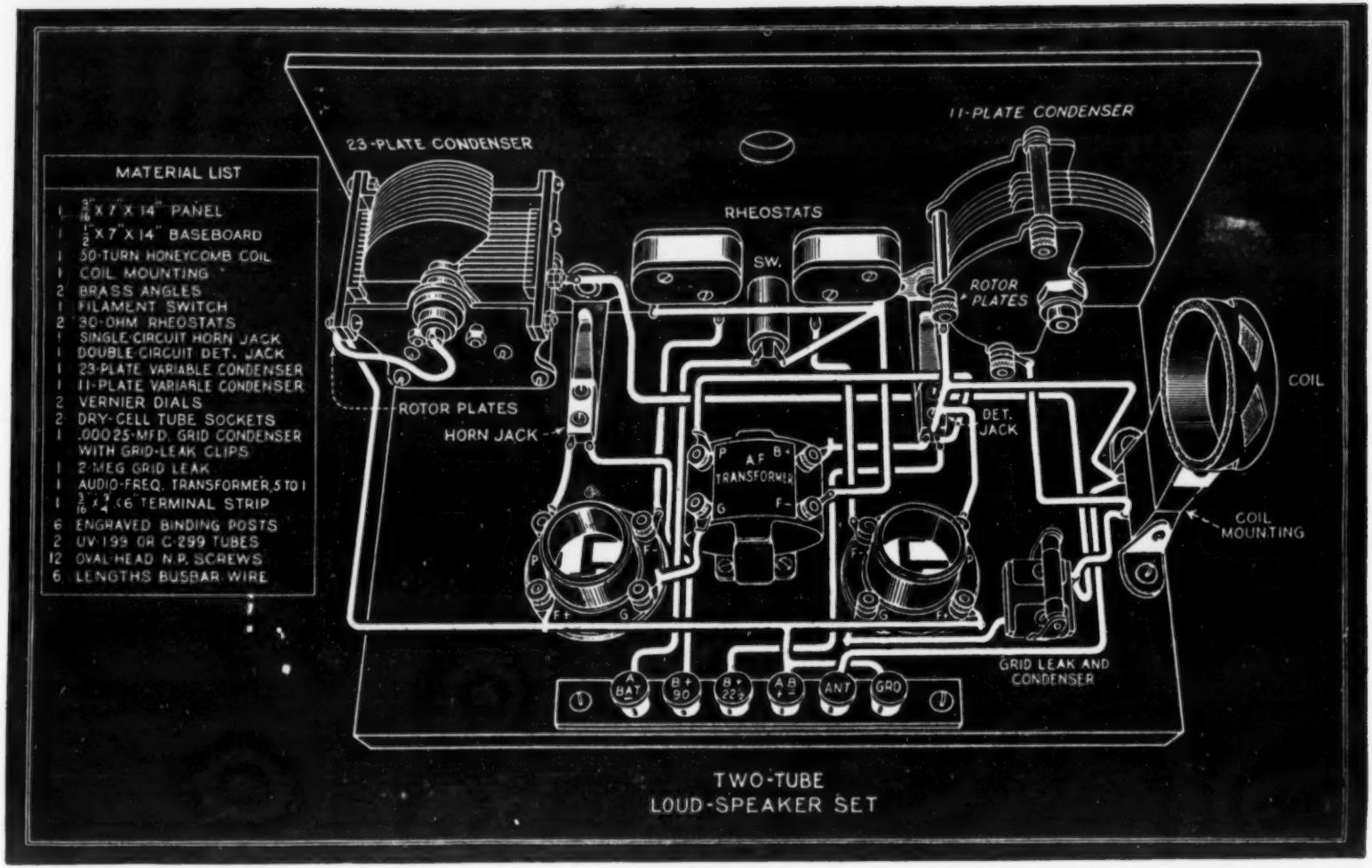
A Simple Two-Tube Loud-Speaker Set

By F. L. Britton

LOUD-SPEAKER volume may be obtained from a simple, inexpensive two-tube set, built and thoroughly tested in Popular Mechanics laboratory. This set has a range on the loud speaker of 50 miles, will easily bring in stations 1,000 miles away on the headphones, and can be built for about $35.

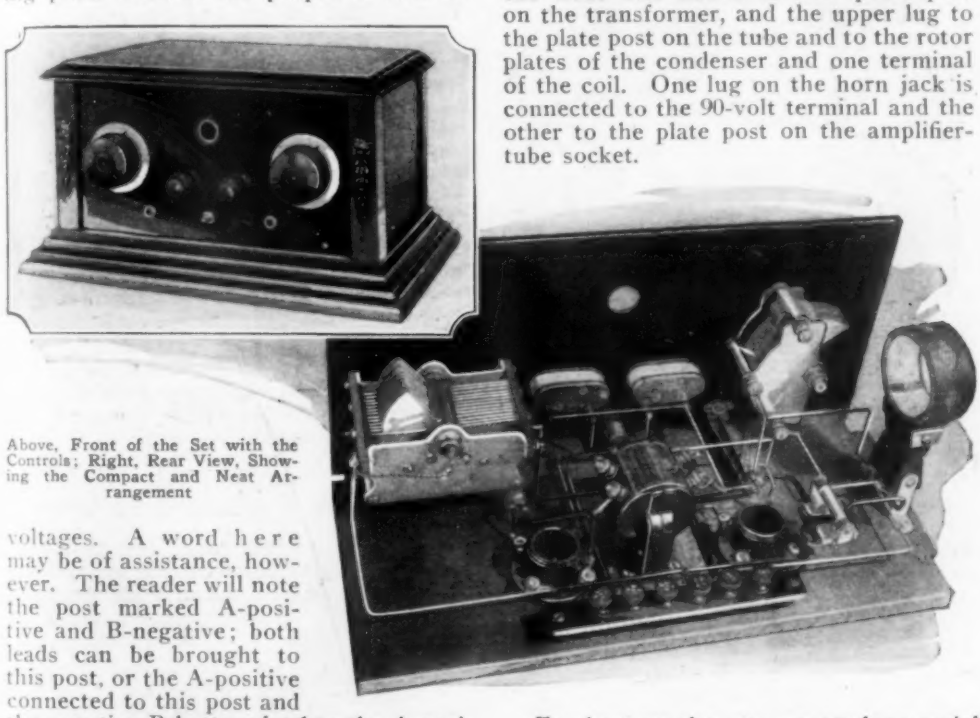
With all Chicago stations in operation, and in spite of the fact that the set was operated within half a mile of the powerful WGN, no difficulty was experienced in tuning in any local station, or in cutting any of them out entirely. In a two-hour test on "silent night" 15 stations, ranging from Omaha, Nebr., to Washington, D. C., and from Minneapolis, Minn., to Dallas, Tex., were logged. Dry-cell tubes are used, and the cost of operation is much lower than with larger sets, but at no sacrifice of audibility or selectivity within the range of the set. One of the greatest advantages of the receiver is ease of construction, as there are no coils to wind. In addition, by simply changing the honeycomb coils, the entire range of wave lengths may be covered, from the high of the commercial and ship stations to the low of the amateur stations. In tuning, connect the A and B-batteries before placing the tubes in the sockets. Make the first tests with the phones. Plug in at the detector jack, push in the filament switch, and turn up the rheostat nearest this jack until you hear a swishing sound in the phones. Turn the variable-condenser knob at the left to the zero point, and slowly rotate the variable-condenser knob at the right until a station is picked up. The variable condenser at the left is for fine tuning and to separate stations that cannot be tuned out with the right-hand condenser alone. It will be found that best results are obtained by using the smallest amount of filament current necessary to operate the detector tube. Back the rheostat off until this point is reached. If more volume is desired, remove the plug from the detector jack and insert it in the horn jack, leaving the detector rheostat in the same position as before. Now turn up the second rheostat until the signal volume is clear and strong. Turn the rheostat no further. If the station received has sufficient volume, the phones can now be removed and the loud speaker

Here Is an Easy-to-Build Set That Will Give Ample Volume on Loud Speaker for Local Stations


MATERIAL LIST
1 3/16 X 7" X 14" PANEL
1 1/2 X 7" X 14" BASEBOARD
1 50-TURN HONEYCOMB COIL
1 COIL MOUNTING
2 BRASS ANGLES
1 FILAMENT SWITCH
2 30-OHM RHEOSTATS
1 SINGLE-CIRCUIT HORN JACK
1 DOUBLE-CIRCUIT DET. JACK
1 23-PLATE VARIABLE CONDENSER
1 11-PLATE VARIABLE CONDENSER
2 VERNIER DIALS
2 DRY-CELL TUBE SOCKETS
1 .00025-MFD. GRID CONDENSER WITH GRID-LEAK CLIPS
1 2-MEG GRID LEAK
1 AUDIO-FREQ. TRANSFORMER, 5 TO 1
1 3/16 X 1 1/4 X 6 TERMINAL STRIP
6 ENGRAVED BINDING POSTS
2 UV-199 OR C-299 TUBES
12 OVAL-HEAD N.P. SCREWS
6 LENGTHS BUSBAR WIRE
23-PLATE CONDENSER
11-PLATE CONDENSER
RHEOSTATS
SW.
ROTOR PLATES
ROTOR PLATES
HORN JACK
DET. JACK
P AF B+
TRANSFORMER
G F-
COIL
COIL MOUNTING
GRID LEAK AND CONDENSER
A BAT
B+ 90
B+ 22½
A B
ANT
GRD
TWO-TUBE
LOUD-SPEAKER SET

plugged in. Any good loud speaker can be used with this receiver. When the instrument is not in use, be sure to turn off the filament switch, and turn the rheostats to the off point.

There are no special details necessary as to construction, as the blueprint illustration of the instrument layout and wiring detail is self-explanatory and the material list appears on the same page. All of the A and B-battery leads are brought out through the rear of the cabinet, as well as the aerial and ground wires. The binding posts indicate the proper A and B-



Above, Front of the Set with the Controls; Right, Rear View, Showing the Compact and Neat Arrangement

voltages. A word here may be of assistance, however. The reader will note the post marked A-positive and B-negative; both leads can be brought to this post, or the A-positive connected to this post and the negative B-battery lead to the A-positive terminal on the dry cells. The detector B-voltage is indicated on the binding post marked 22½; this can be varied as some detector tubes work best on 18 volts, especially when the B-battery is fresh. For the amplifier plate voltage 90 volts can be used, as indicated, or it may be found that 67½ volts are sufficient.

The A-battery consists of three No. 6 dry cells connected in series. Two 45-volt tapped B-battery units are used; these are connected in series and tapped off as follows: The negative lead of the first B-battery unit is connected either to the A-positive post on the terminal strip, or to the positive terminal on the dry-cell A-battery; the 22½-volt positive lead is connected to the terminal strip, and the 90-volt B-battery lead taken from the further end of the second B-battery unit to the post on the strip. Remember not to place the tubes in the sockets until the A and B-batteries have been connected. To save those who are unfamiliar with jacks any difficulty in wiring, it might be mentioned that the bottom lug on the detector jack is connected to the 22½-volt terminal on the strip; the one immediately above this to the B-positive post on the transformer; the next one above to the plate post on the transformer, and the upper lug to the plate post on the tube and to the rotor plates of the condenser and one terminal of the coil. One lug on the horn jack is connected to the 90-volt terminal and the other to the plate post on the amplifier-tube socket.

For best results, use an outdoor aerial consisting of one wire from 75 to 100 ft. long, and solder or clamp the ground lead to a cold-water or radiator pipe.

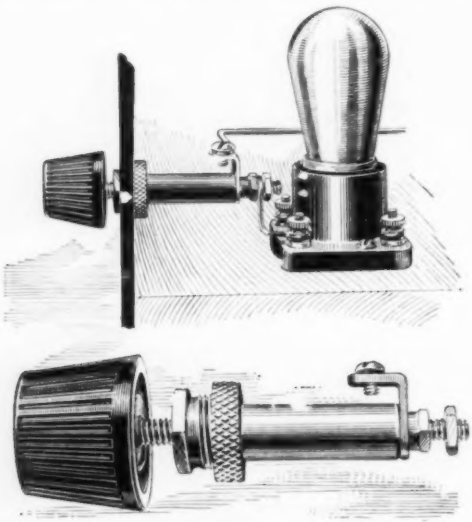
Examine "Dead" Transmitting Tubes before Discarding Them

Before consigning the "dead" tube to the waste basket, examine the wires inside of the stem leading from the terminals. They may be burned off or have become unsoldered, causing an open circuit. This often happens in transmitting tubes, and is easily remedied with a bit of wire and solder.

A blueprint of this set, 15½ by 24 in. in size, will be sent to any reader upon receipt of 5 cents to cover the cost of mailing. Address the Radio Dept., Room 514, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

Rheostat Permits Neat Mounting

A new rheostat designed to give a smooth vernier filament control has made its appearance on the market. This rheostat requires only one mounting hole, and can be inserted in the hole from which the old rheostat has been removed. It is claimed to be vernier all the way, with but one adjustment to make, and can be used for any tube, or combination of tubes. It is very compact. A particularly neat arrangement of the rheostat is shown in the upper drawing. Here the end of the rheostat is so close to the socket that it can be connected to the latter by means of a lead only about ½ in. long.



Compact Rheostat of the Graphite-Disk Type That Permits Neat Arrangement

Device Protects Tubes

Designed for use in the positive lead of the B-battery, a tube protector recently developed prevents damage if a negative lead of the B-battery becomes crossed with any of the other wiring of the set. The device is not a fuse, and the claim is made that it will not burn out. It also conserves the B-battery by limiting the current flow, yet allows ample current to pass to work the detector and amplifiers.

¶THE 1-TUBE ULTRA-AUDION has proved an immense favorite. It was completely described in our April, 1924, issue. Those of our readers who missed this, may obtain the issue by sending 25 cents to the Circulation Department.

Label Your Battery Leads

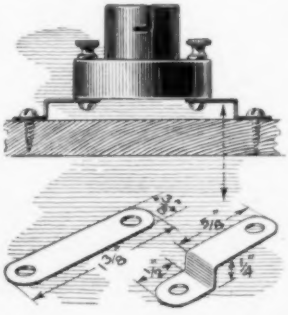
It takes but a few minutes to make a set of little square or round cardboard labels for the A and B-battery leads, holes being punched in the labels and the wires threaded through them, and the fan who has burned out a few tubes by accidentally connecting the B-battery to the filament circuit will appreciate the tip. For those who want something a little more pleasing to the eye than the cardboard labels the latter can be made of brass. The labels should bear the name of the battery, the voltage and the polarity.

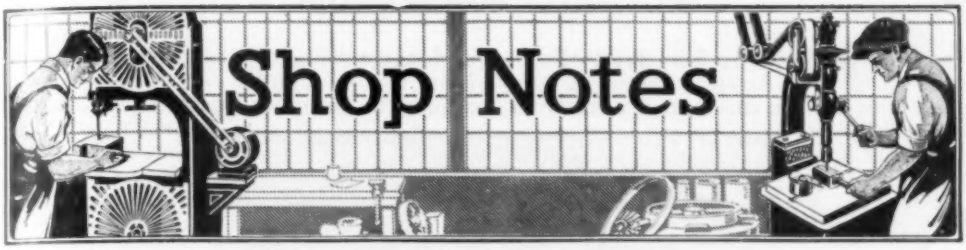
Inspect Aerial and Ground before Summer

An occasional inspection of the aerial and ground should be a religious duty of the owner of the receiving set, but especially after the last snow has disappeared from the ground. Winter storms impose a heavy strain on the aerial and masts, and these should be gone over thoroughly to see that they have not been damaged, or the aerial accidentally grounded. There is also the danger that soldered connections have become corroded during the season of alternate snow, sun and rain, and these should be looked to also.

Making Cushioned Sockets

During the past year many radio-tube sockets have been cast aside for the new types appearing on the market, which are guaranteed against microphonic action and other tube noises due to vibration. In the accompanying sketch is shown how these discarded sockets may be reclaimed for further use and made just as free from microphonic action as any of the new types. All that is required to accomplish this is some hard sheet brass, approximately 1/32-in. thick and of large enough area to allow a sufficient number of clips to be cut from it, as shown in the drawing. These clips are easily made in any bench vise, and the cost is very small.





All Shop Notes published in 1924, in book form—Fifty Cents—from our Book Department

Ventilating the Dark Room

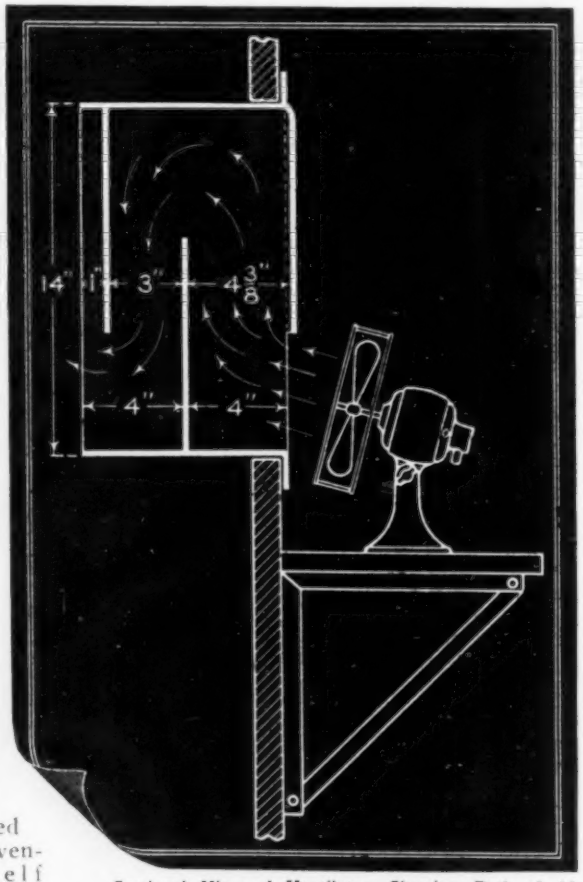
By L. F. O'TOOLE

VENTILATING the photographic dark room is not as easy a matter as ventilating any other sort of room, owing to the fact that while a current of air is desired, no light must be admitted. In many commercial dark rooms, while satisfactory methods of excluding light are used, the ventilation situation is not so good, and the occupants, especially in the summertime when the temperature hovers around the 80° mark, are not to be envied. This is a disagreeable condition, but one that is fortunately easily remedied in the majority of cases.

The ventilator shown in the illustrations has been found very satisfactory in a case like this, as it excludes the light, but permits the air to be changed regularly. It is made of galvanized iron, set in a hole cut in the wall, and contains a series of blades so set that the air will work through it automatically. As shown in the sectional diagram, the casing is about 8 in. deep and 14 in. square; 1 in.

Working Conditions in the Dark Room Will Be Improved Greatly When This Simple Ventilator Is Installed; Insert, Outside View of Ventilator

from the outside edge a 9-in. sheet of galvanized iron is soldered to the upper side of the box, on the inside, and 3 in. from this a similar sheet is soldered to the bottom. A sheet of about the same dimensions, cut at the bottom to approximately the radius of the blades of the electric fan used with the ventilator, is riveted and soldered to the inner side of the box as shown in the photo and diagram, and the ventilator is finished. Under ordinary conditions a current of air will work through the ventilator as the warm air in the room rises. If forced draft is desired, the electric fan is placed in front of the ventilator on a shelf supported on angle-iron brackets, and this forces the foul air out effectively. One ventilator—the one provided with the fan—is placed near the ceiling on the dark-room wall, while another similar one is set on the opposite side of the room in a hole cut in the wall near the floor. Any other arrangement that may be found satisfactory, can, of course, be used. The air forced out through the upper ventilator is replaced by air drawn in through the lower one. This lower ventilator is a very essential part of the installation, as, in a completely light-proof dark room, there are no cracks that can be depended upon to leak in the air necessary to replace that blown out through the upper ventilator. Instead of the lower vent, a hole can be cut through the dark-room door, if desired, and fitted with sheet-metal louvers. A sheet of black cloth, tacked above the opening and allowed to hang over the louvers, will allow ventilation while excluding light.



Sectional View of Ventilator, Showing Path of Air and Position of Electric Fan

Spacing Nails on Boxes

Observations of packages which have failed in service and tests on packing boxes by the U. S. Forest Products Laboratory have shown that the most common defect in box construction is inadequate nailing. Attempts to strengthen boxes by the use of thicker lumber, without regard for nailing, very often only waste material.

Nails holding boards to the end grain of the box end should be spaced 1¾ in. apart, and nails holding boards to the side grain of the end, 2 in. apart, when nails are 6-penny, or less. Increase the spacing ¼ in. for each penny over six. No board should have less than two nails at each nailing end. Space the nails holding the top and bottom to the sides 6 in. or more apart, when the nails are 6-penny or less, increasing the spacing 1 in. for each penny over six.

While such spacing may appear to be too close, it actually calls for only about two-thirds of the number required to balance the strength of the nailed joints with the strength of the box in other respects. With the spacing given above, the nailing is still the weakest point of the box.

A Stain for Glass Windows

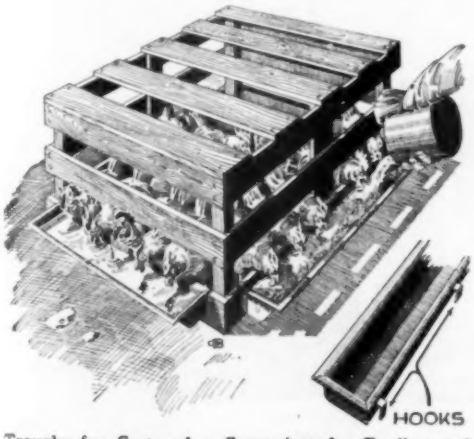
Window staining, for privacy or other purposes, can be quickly and cheaply done at home without calling in a professional workman. The only materials required are white shellac, dye of the desired color, and waterproof varnish.

For a white window, which admits light, but which is not transparent, coat the glass carefully with white shellac, dissolved in alcohol. After the shellac is dry, apply another coat, if necessary; then, after drying again, cover with the waterproof varnish. Such a window can be washed indefinitely without removing the stain.

Colored windows are made by mixing ordinary cloth dyes into the shellac until the desired shade is attained. For instance, for photographic darkroom use, mix orange and crimson dyes into the shellac until it is very dark.

Feeding Troughs for Poultry

Customarily grocers, butchers and commission merchants feed and water fowls by throwing handfuls of loose grain into the crate and placing trays of water outside. This method is, however, rather objectionable due to the muss caused by scattering grain and spilling water. A better method is shown in the drawing. Galvanized-iron troughs, which can be made by any tinsmith at a small expense, are hooked on the slats of the crates as indicated, one being used for water and



Troughs for Crates Are Convenient for Feeding and Watering Fowl

the other for feed. They should extend along the entire side so that all the birds have an equal chance.

Rollers Aid in Testing Tubes

Experiencing some difficulty in testing large auto tubes, a Wisconsin vulcanizer constructed a pair of rollers and attached

Wooden Rollers Attached to Vulcanizer's Water Tank Facilitate Testing Tubes

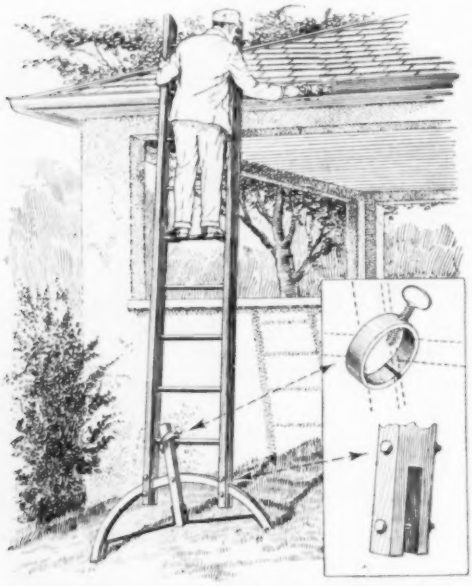
them to the water tank to hold the tubes submerged. Two wooden rollers, about 3 in. in diameter, are mounted on a frame and axles, which are made of heavy galvanized-iron wire. The ends of the wire are looped and passed through small holes in the rim of the tank to serve as hinges, and the projecting part of the wire on the other side of the rollers is bent to form a double hook that snaps over the rim on the opposite side of the tank. In use, the device is raised to allow the inflated tube to be put into the tank and the rollers are then put down. It is an easy matter to move the tube back and forth so that every portion may be observed under water, and the operator is not compelled to keep his hands in the water.—G. E. Hendrickson, Argyle, Wis.

Lubricating High-Speed Shafts

The lubrication of high-speed shafts or bearings can be facilitated by treating the packing with a special lubricant. Take 2 oz. of gold, silver, aluminum or similar bronze powder and 6 oz. of ordinary cup grease. Mix these thoroughly and treat the packing with the resulting mixture before it is put into the packing box. This lubricant, I have found, gives at least fifty per cent longer service than untreated grease.—James E. Noble, Toronto, Can.

Adjustable Footing for Ladder

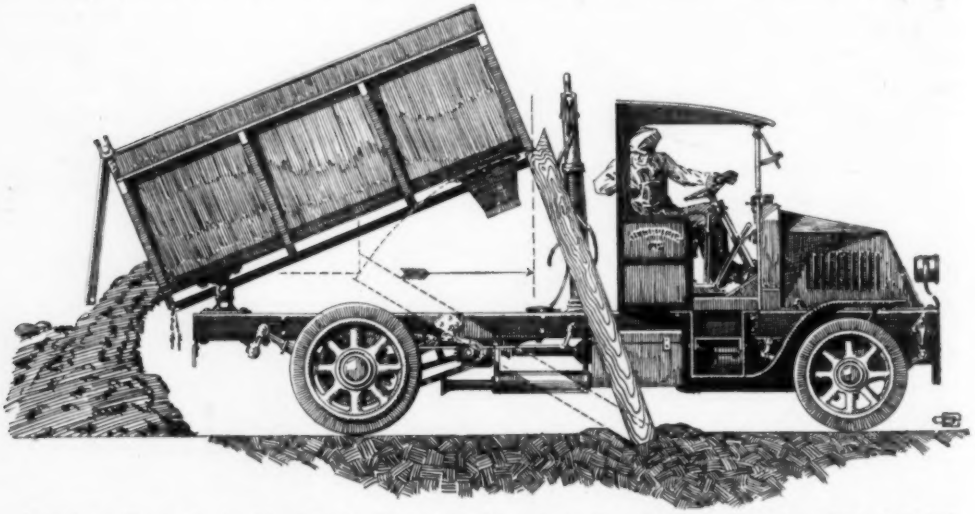
Painters, carpenters, tinsmiths and others whose trade necessitates the frequent use of a ladder, are often inconvenienced by the ladder slipping toward one side due to a slight slope in the ground. The usual remedy, which anyone naturally thinks of first, is to block up the ladder, but blocks are not always handy. A detachable footing of the kind shown in the drawing is much more reliable, and as it is a small article it can readily be transported with the other equipment. It consists of a section of buggy-wheel rim, or any stout length of similarly curved wood. A slot is cut in each leg of the ladder to straddle the rim, and a short length of hardwood is fastened to it by means of a bolt and two strap-iron braces, as shown. The upper end of this stick is passed through a heavy iron ring, which is permanently kept on the lowest rung of the ladder. This ring is attached by splitting it and then spreading it, after which it is placed around the rung and bent back to its original shape. A thumbscrew threaded through the side of the ring, is turned down to clamp the stick to the rung at any position. Bolts are put through the bottom of the ladder as shown in the detail, to prevent splitting and to retain the foot in position. The ladder can be set up straight, and after the screw is tightened, there will be no danger of slipping.—G. E. Hendrickson, Argyle, Wis.



Adjustable Footing for Ladder Permits It to Be Set Up Straight without Any Danger of Slipping

Simple Method of Dumping Trucks

A driver on a dump truck had the misfortune to break the mechanism that dumped the load. However, he devised a simple method of dumping the load without any help. When ready to dump he placed a 4 by 4-in. timber underneath the front edge of the body as indicated by the dotted lines in the drawing so that when the truck was driven ahead the body would be raised and the load dumped automatically.—Louis Latour, Plattsburg, N. Y.



Dumping a Heavy Truck with a Wooden Prop Set underneath the Front Edge of the Body, Which Is Raised by Driving the Truck Ahead

Low Wagon for Silo Filling

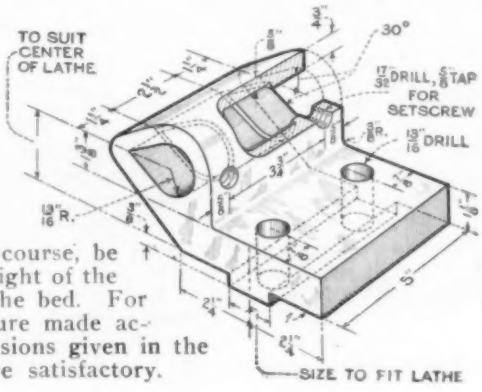
For filling silos, or other work about the farm, a low wagon is often convenient. To convert the ordinary high wagon into one of this type the reach is removed, and two 2 by 6-in. oak planks, about 16 ft. long are fastened edgewise to the underside of the rear axle, about 4 ft. apart. They should be held in place with U-bolts or wire. The forward ends are next brought together, and a 2 by 6-in. plank, about 10 in. long, nailed between them. This shorter plank should have a hole drilled through it so that it can be secured to the underside of the front axle by the kingbolt.

This V-shaped frame, which will easily carry a one-ton load, takes the place of the reach. On it, and far enough back so that the front wheels will not interfere while turning, a platform, about 7 ft. wide, is constructed of planks.

A wagon of this type is so low that, when in use, the fodder may be loaded or unloaded directly from the ground, and without an extra man on top being necessary, thus effecting a saving both in time and expense.—John T. Bartlett, Boulder, Colo.

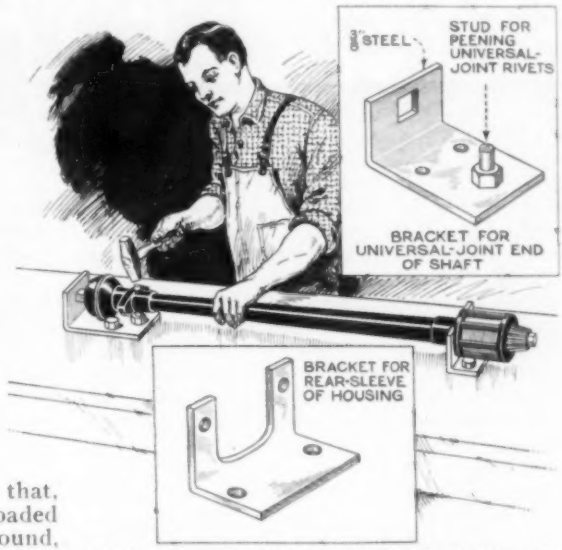
Boring-Bar Holder

A boring-bar holder for the lathe, which will hold all sizes of boring bars within its limits, without bushings, is shown in the illustration. The head is machined to the shape indicated and a hole is cut through it as shown. The center part of the head may be cut out if desired to eliminate the danger of having high spots inside and thus permit a more accurate fit of the boring bar, besides reducing the weight of the fixture. Holes are drilled and tapped in the side for setscrews to tighten the boring bar in the holder and also through the base for bolts to fasten the holder to the lathe bed. The height of the fixture should, of course, be such as to suit the height of the lathe centers above the bed. For average work, a fixture made according to the dimensions given in the illustration will prove satisfactory.



Handling Ford Driveshafts

Ford driveshafts can be conveniently handled on the workbench by providing two brackets of the kind shown in the illustration. These are made of ⅜-in. flat steel cut and bent to the shape indicated and bolted to the bench top. One bracket has a square hole to receive the universal-joint end of the shaft and the other is cut to hold the rear sleeve of the housing.


3/8" STEEL
STUD FOR PEENING UNIVERSAL-JOINT RIVETS
BRACKET FOR UNIVERSAL-JOINT END OF SHAFT
BRACKET FOR REAR-SLEEVE OF HOUSING

Brackets on Bench Aid Handling of Ford Driveshafts

Testing Machine Parts for Cracks

Testing machine parts for cracks can be accomplished very easily in the following way: The surface is first cleaned and then the suspected area is coated with a mixture of whiting and water, mixed to the consistency of a thin cream. After this coating has dried the piece is vibrated by slight tapping, which will cause the coating to crack if there is a crack in the metal. The whiting will absorb enough oil along the crack to discolor it slightly at the edges, which will make the crack show up immediately.—Sherwood J. Gee, Montpelier, Idaho.

Pulley and Gear Speeds and Sizes

BY JAMES TATE

"JOHNNY," said Bill, the shop foreman, "Old Hank is busy. Run over to the south shop at lunch time, and put a pulley on the lineshaft for that new grinder. The lineshaft speed is 200 r.p.m., and the countershaft should run at 450. Get a pulley from the store." Johnny hesitated, but he was ashamed to let Bill know that he didn't know what size of pulley he must get—in fact, he hadn't the slightest idea in the world how to figure it out. He went off to the store and tried to bluff the storekeeper by asking for "the lineshaft pulley for that new grinder," but, when the storekeeper asked, "What size is it?" Johnny was stumped again. He scratched his head in despair and turned away from the store window, to meet the gaze of Bill, who was regarding him quizzically. "What's the matter, Johnny? No pulleys in the store?" "Yes, sir," said John, "b-but I don't know what size I need." "Never mind, boy," said Bill, "that's no crime; lots of older men than you don't know how to figure pulley sizes, but your real fault was in not confessing it at once. Get an 18-in. pulley and put it on, then come over to my desk, and I'll fix you up so you'll never be stumped again."

"Run Over to the South Shop and Put a Pulley on the Lineshaft"

"Figuring pulley sizes," explained Bill, when Johnny reported to him an hour later, "is a very simple matter—when you know how. Now, that countershaft had to run at 450 r.p.m., as I told you, and the lineshaft runs at 200 r.p.m. The first thing to do is to measure the diameter of the pulley on the countershaft. That was 8 in., wasn't it? Now, we have all the figures for a simple sum in proportion. You know that the diameter of the lineshaft pulley is the unknown, and that the diameter of the countershaft pulley is the other similar term, so you have the ratio 8 : Answer. Now, the countershaft is to run faster than the lineshaft, therefore the diameter of the unknown pulley will be the larger, and we must arrange the other terms of the proportion so that the answer will be greater than 8. So we state the proportion like this—200 : 450 = 8 : Answer; thus putting the smaller number of revolutions as the first term, and the greater as the second term. Multiplying 450 by 8, and dividing the product by 200, we get 18, the diameter, in inches, of the lineshaft pulley.

"Now, if you will look closely at the problem, 200 : 450 = 8 : 18, you will see that the first and fourth terms are the numbers relating to the same pulley—the one on the lineshaft; and that the second and third terms also relate to the same

866

pulley—the one on the countershaft. This allows us to form a very simple rule, which we can apply to all pulley problems. The product of the diameter and revolutions of one pulley equals the product of the diameter and revolutions of the other. So that, if we multiply together the diameter and number of revolutions per minute relating to the pulley of which we know both, and divide by the number, whether it is r.p.m. or diameter, that we know of the other pulley, the answer is the number we want to know. That's what we did just now. We multiplied the r.p.m. and diameter of the countershaft pulley, 450 and 8, and divided by the only number we had relating to the lineshaft pulley—200—and the answer was its other figure, the diameter. Supposing, now, you knew that the pulley on the lineshaft was 20 in. in diameter, and the one on the countershaft was 8 in. in diameter as before, but the lineshaft runs at 250 r.p.m.; how would you figure the speed of the countershaft? Just as before; multiply 20 by 250, the product is 5,000. Divide this by the diameter of the countershaft pulley—8—and the answer is 625, the speed of the countershaft.

"Don't forget this simple rule. Multiply together the diameter and speed of one pulley, and divide by the diameter or speed of the other.

"But supposing you have a machine that is driven through a countershaft and you want to know the speed of the machine spindle itself? You know the speed of the line and countershafts, and the diameters of the pulleys on the lineshaft, countershaft, and the machine. Now, we have two sets of driving pulleys, or drivers, and two sets of driven pulleys, or followers. There is another very simple rule for this; multiply together the speed of the first driver and the diameters of all the other drivers, and divide by the product of the diameters of the followers. Taking the sizes and speeds we used before, the lineshaft speed is 200 r.p.m., the countershaft speed is 450 r.p.m., the lineshaft pulley is 18 in. in diameter, the follower on the countershaft 8 in., the driver on the countershaft 10 in., and the pulley on the grinder, which is also a follower, 6 in. in diameter (see Fig. 1). Multiply 200 by 18 and by 10; the product is 36,000; multiply 8 by 6, and divide this product into 36,000; the result is 750, and this is the speed of the machine.

"A quicker way to do the calculation is to set the figures down in the form of a fraction, then some of them can be canceled out (example 1). Now 8 will divide into 200 and 6 into 18, so that we only have to multiply 25, 3 and 10 and this saves much figuring. If we knew the speed at which the grinder had to run—

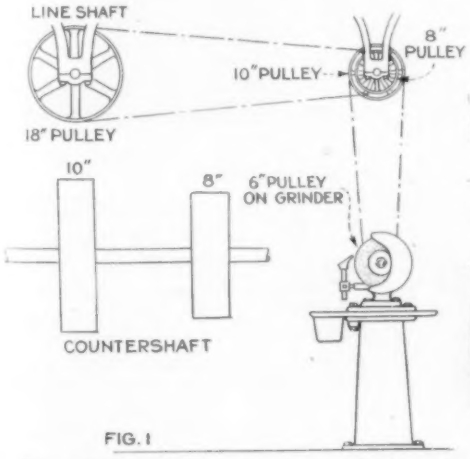


Fig. 1 Illustrates the Problem of the Grinder and Its Drive and Fig. 2 How the Lathe Is Driven and the Speed Figured

750 r.p.m. — but wanted to find out what size of pulley to put on it, the process would be the same, but in this case we would divide the product of the speed of the first driver and the diameter of all the drivers by the product of the speed of the last follower and the diameter of the other followers. Setting this down in the form of a fraction (example 2), we find the diameter to be 6.

$$\frac{25 \quad 3}{200 \times 18 \times 10} = \frac{25 \times 3 \times 10}{1} = 750$$
$$8 \times 5$$

EXAMPLE 1

$$\frac{25}{200 \times 18 \times 10} = \frac{18}{3} = 6$$
$$750 \times 8$$
$$3$$

EXAMPLE 2

$$\frac{8 \quad 7}{200 \times 14 \times 10} = \frac{56}{18} = 3\frac{1}{9}$$
$$750 \times 12$$
$$3 \quad 6$$

EXAMPLE 3

"Supposing, again, that you are belting up a lathe to be driven from a motor to a lineshaft, then to a countershaft (Fig. 2), and the countershaft must make 200 r.p.m. The countershaft you have has a 10-in. pulley in addition to the cone pulleys and there is a 14-in. and a 12-in. pulley on the lineshaft; the motor speed is 750 r.p.m. What size pulley must be used on the motor? The pulley on the motor is to drive the 14-in. pulley on the lineshaft, and the 12-in. pulley on the lineshaft the 10-in. one on the countershaft. Never mind the usual open and crossed belts. We have now the speed of the last follower, 200, and the diameters of the followers, 14 and 10; also the diameter of one driver, 12, and the speed of one, 750. We multiply the first three together and divide the product by the product of the last two; the result is 3⅑, and if we make the pulley 3⅛ in. in diameter we shall be very close to the proper speed. Stated again as a fraction, you see the calculation (example 3) is simple.

"Run along now, and tomorrow I'll show you how to figure gear sizes and speeds."

RULES FOR CALCULATING THE SPEED AND SIZE OF PULLEYS

The driving wheel is called the driver, and the driven wheel the driven or follower.
R. p. m. indicates the number of revolutions per minute.

Problem 1.—The revolutions of driver and driven, and the diameter of the driven being given, required the diameter of the driver.

RULE.—Multiply the diameter of the driven by its number of revolutions, and divide by the number of revolutions of the driver.

Problem 2.—The diameter and revolutions of the driver being given, required the diameter of the driven to make a given number of revolutions in the same time.

RULE.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the given number of revolutions of the driven.

Problem 3.—The diameter and number of revolutions of the driver, with the diameter of the driven, being given, required the revolutions of the driven.

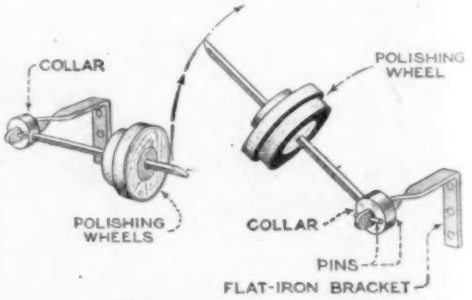
RULE.—Multiply the diameter of the driver by its number of revolutions, and divide by the diameter of the driven.

Problem 4.—The diameter of the driver and driven, and the number of revolutions of the driven, being given, required the number of revolutions of the driver.

RULE.—Multiply the diameter of the driven by its number of revolutions, and divide by the diameter of the driver.

Storing Polishing Wheels

When a number of polishing wheels are used, it is advisable to provide a suitable method of storing them. Some shops use pegs on the wall for this purpose, hanging a wheel on each peg, but a better method is to hang all of them on one support so devised that any one wheel can be removed quickly. Such a support is shown in the illustration. It consists of two iron brackets, twisted and bent as shown and attached to the wall, and an iron rod cut in two on a slant at the center. A collar is fitted on each bracket end and held by pins. A hole is drilled and tapped through one of them and halfway into the other for attaching the supporting rod. In mounting the two parts of the latter, one is brought



Support for Holding Polishing Wheels Permits Them to Be Removed Easily

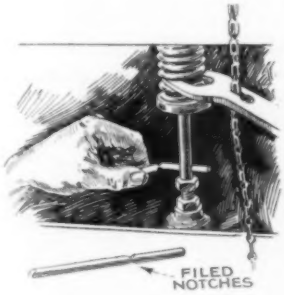
up against the flat bracket so that the collar and rod form an immovable unit, while the other unit can be turned upward. Evidently the slanting ends should bear against each other as indicated in the drawing, and both halves should be long enough to accommodate all the wheels to be stored, or it would be impossible to remove the innermost one at either end.

Garage Patrons Indicate Service Desired by Cards

In a garage where a large number of trucks and pleasure cars were stored, patrons frequently found that their cars were not given certain attention, such as washing, filling of the gasoline tanks, and the making of minor repairs. This work was to be done overnight, and as many of the customers were transients, a loss resulted to the garage owner. He, therefore, made up a set of metal signs, painted in black and white, and indicating the kind of service desired. These signs were kept near the garage door in a rack. The patrons placed the signs on their machines, and the attendants gave the service desired without further orders.—L. E. Turner, Brighton, Mass.

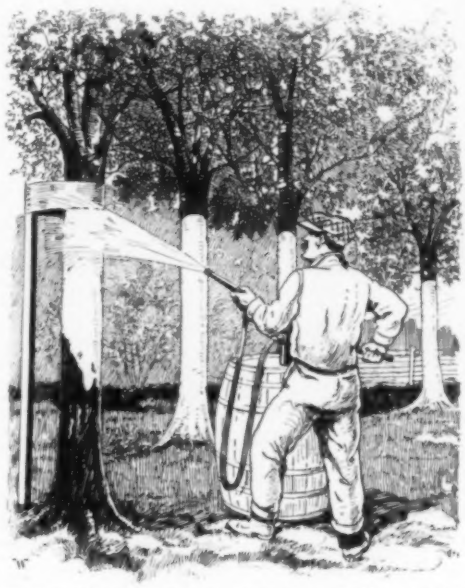
Inserting Valve-Spring Pins

It is usually rather difficult to insert auto valve-spring pins, which keep the springs under proper compression. This is due to the cramped quarters in which it is necessary to hold the pin, and there is always danger of dropping the pin into the crankcase, from which it is difficult to remove. A number of connected pins can, however, be made from a length of stiff wire of the proper diameter, and can be inserted without danger of losing them, if the following method is used: Notches are filed in the wire so that after the end is inserted through the hole in the stem, the wire can be broken off at the first notch, leaving the pin in its place. If wire of the proper size is not available a long nail will give just as good results.—G. C. Douglas, Raleigh, N. C.



Whitewashing Trees

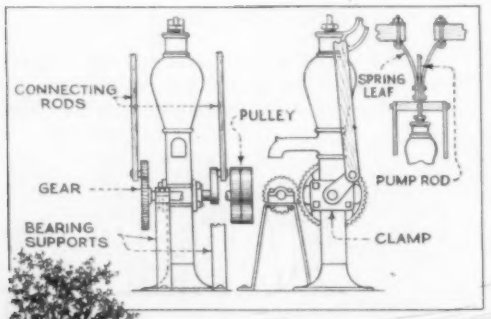
When trees in an orchard are whitewashed it looks much better to have the sprayed parts all of uniform height. This can be done by using a strip of oilcloth, about 12 in. wide and long enough to encircle the largest trees. One end of the strip is tacked to the end of a pole as shown in the drawing, the pole being 2½ ft. longer than the height of the part to be whitewashed. After the strip is wrapped around the tree a few turns, the sprayer can be used and there will be no ragged edge when finished.



Whitewashing Trunks of Trees to a Uniform Height Improves Appearance of Orchard

Removing Paint and Varnish

The most efficient method of removing old paint and varnish is to burn the surface with a painter's blowtorch. The heat causes the film to soften and it can then be scraped off easily. This method, however, can only be used on flat surfaces, and where a slight scorching of the wood is not objectionable. A hot solution of caustic soda (concentrated lye), 1 lb. to the gallon of water, is also efficient. This should be applied with a fiber (not bristle) brush until the paint softens. This solution is very hard on the hands, and also raises the grain of the wood, and surfaces treated with it should be thoroughly washed and dried before repainting.



Irrigation of Several Acres Carried On Economically with a Multiple-Pump Arrangement Run by One Engine; Walking Beams Are Extended from the Plunger Rod of the Center Pump to the Auxiliary Pumps

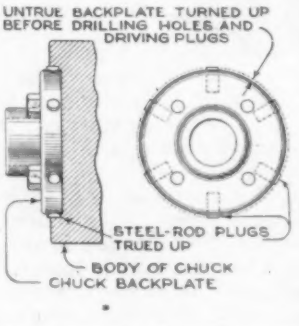
A Small Irrigation Plant

Where water does not lie more than 20 ft. below the surface, the irrigation of several acres can be accomplished economically by the method shown in the drawing. An ordinary pump jack is installed for permanent service on the pump and a small gasoline engine provided to run it. By means of walking beams, arranged as shown in the drawing, it is an easy matter to operate two or more smaller shallow-well pumps at the same time. The drawing shows how this is done.

To the top of the plunger rod projecting from the center pump are riveted the halves of two auto leaf springs; the longest and most flexible obtainable. These springs are fastened to walking beams by means of U-bolts, heated and formed in the spring eyes. The walking beams are 8-ft. lengths of 2 by 6-in. material, pivoted in the center on wooden posts and being connected to iron-rod extensions on the plungers of the smaller pumps as shown. At all three bearing points on the walking beam the parts must be pivoted and free from binding. Ordinarily three pumps can be operated by the same engine used to operate a deep-well pump. The water may all be collected in a single flume and then directed to the acreage, or it may be directed into separate ditches as shown. In case four auxiliary pumps are used the top of the plunger rod of the deep-well pump must be squared and the holes for the rivets offset or staggered so that the rivets will clear each other.—Dale R. Van Horn, Walton, Nebr.

Truing a Chuck Backplate

A universal-lathe chuck was found to be running considerably out of true and the trouble was found to be caused by the backplate itself running off, perhaps due to the wearing of the threads or to a slight springing of the spindle nose. As it was impracticable at the time to make up a new backplate, the old one was removed from the chuck body, into which it fitted tightly in a counterbored recess, and screwed tightly on the lathe nose after carefully cleaning the threads, collar, face and backplate boss to make sure there was no dirt

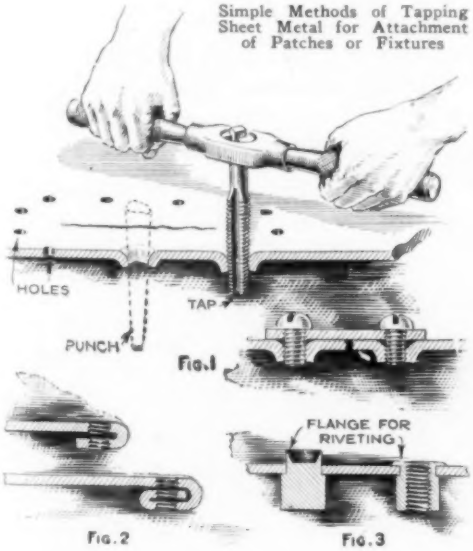

UNTRUE BACKPLATE TURNED UP BEFORE DRILLING HOLES AND DRIVING PLUGS
STEEL-ROD PLUGS TRUED UP
BODY OF CHUCK
CHUCK BACKPLATE

or chips to prevent the surfaces from screwing tightly together. The edge and front face of the backplate were then trued up, by taking light cuts until the cut showed all over the surface. Then six holes were drilled radially into the edge of the plate and plugs made from steel rod were driven in tightly until they bottomed. An electrically driven toolpost grinder was then attached and the six projecting plug ends ground off while the backplate was revolving, until the chuck body was a drive fit over them. It was then bolted on and found to run satisfactorily once more.

Threading Holes in Thin Plate

In sheet-metal work it is frequently necessary to tap holes for attaching patches, brackets, nipples, lugs, or other fixtures. One then is met by the difficulty that the metal is too thin to permit cutting a good thread. The illustration shows three methods of overcoming this. By drilling the holes smaller than actually required and using a taper drift or punch to flare out the metal, as shown in Fig. 1, sufficient surface is provided for the tapping of a long thread. A patch can then readily be screwed down tight. Another way of obtaining the same result at the edge of a sheet is to bend the metal over once or twice as shown in Fig. 2. In cases where a still longer thread is required, a hole may be drilled for a small bushing,

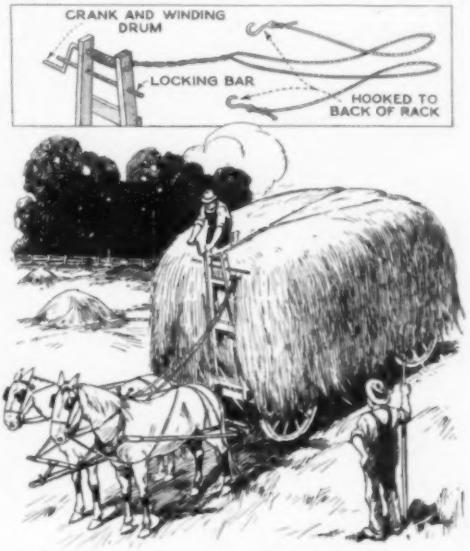
Simple Methods of Tapping Sheet Metal for Attachment of Patches or Fixtures



which is riveted to the plate as shown in Fig. 3. The bushing is then drilled and tapped.—G. A. Luers, Washington, D. C.

Substitute for Binding Pole

Instead of carrying a cumbersome binding pole when hauling hay or fodder, a Wisconsin farmer uses a cable and wind-

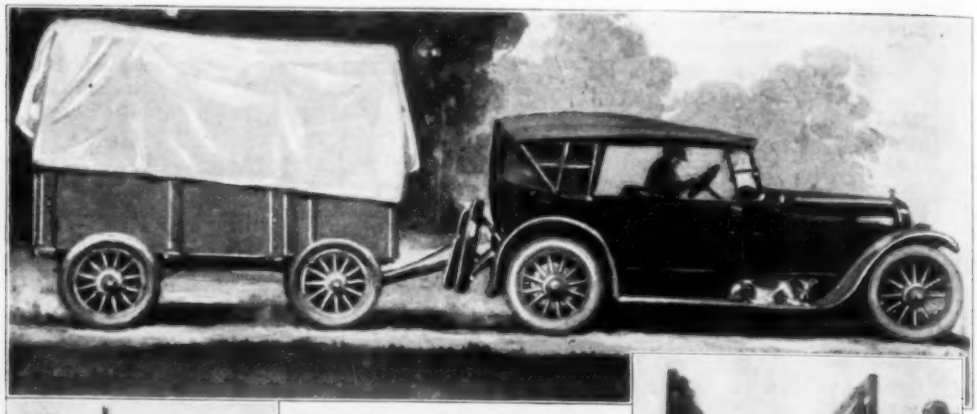


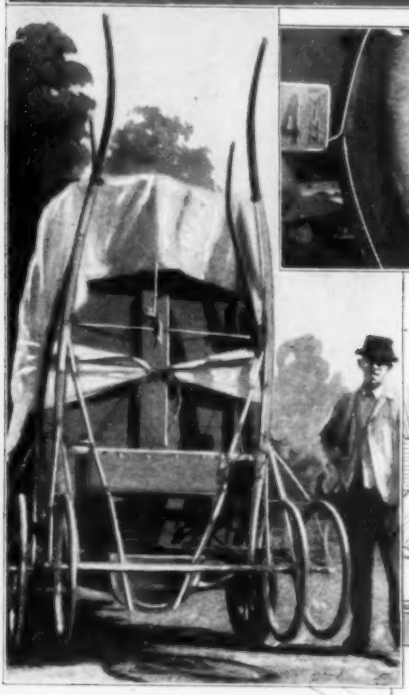
Rope and Winch Substituted for Cumbersome Binding Pole on Hayrack

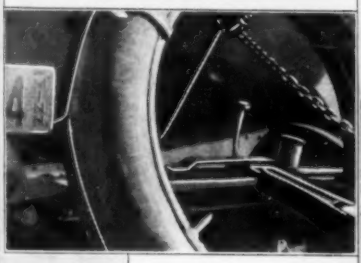
lass as a substitute. The rope is provided with a hook at each end and is securely attached, at its center, to the winch. This is made from a length of gas pipe and is slipped through holes drilled in the front ladder of the wagon, a locking bar being also provided, as indicated, to keep the crank from turning after the rope has been drawn up tight. In use, the rope is brought over the load in the usual way, the hooks being fastened to the wagon frame at the rear, and the winch then used to tighten the rope over the load.

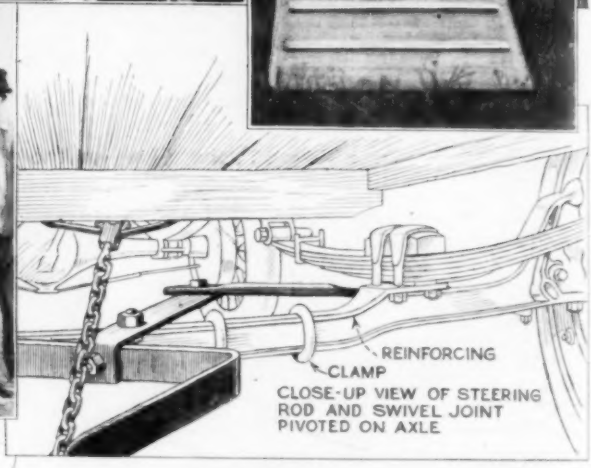
Joining Roofing Sheets

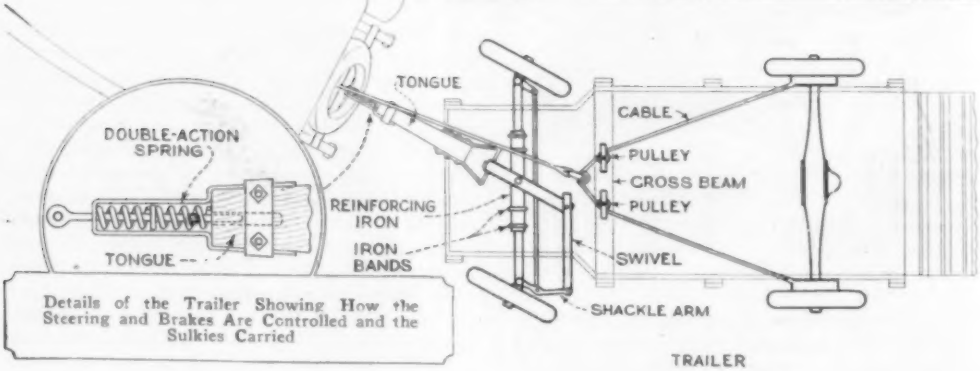
When copper and zinc-roofing sheets come in contact with each other in the open atmosphere, there is a certain amount of electrolytic action and this starts corrosion. This can readily be prevented by coating the copper and zinc with roofing cement or acid-proof paint, before the metals are joined. Of course, the connection between the two metals cannot be avoided entirely. Zinc should never be used on a roof to be covered with red cedar or redwood shingles, as acid is formed when the shingles absorb moisture and this will soon ruin the metal. —L. H. Georger, Buffalo, N. Y.











Details of the Trailer Showing How the Steering and Brakes Are Controlled and the Sulkies Carried

An Unusual Automobile Trailer

By R. A. FRANKLIN

DURING last summer, those who had horses entered in races at various fairs in Minnesota and adjoining states encountered considerable difficulty in transporting them from place to place on time. One owner, Mr. W. J. Snellinger, decided to find a way to avoid these troubles, save freight, and be sure of the safety of his prized racer, Lou Randall. The method he used is applicable not only to similar situations, but may be useful to others who must transport cattle or other animals often and in safety.

He purchased a used car, dismantled it, and built upon the chassis a comfortable stall, 4 by 10 ft. in size and 3 ft. 6 in. in height. The upper photo in the illustration shows the trailer as it appears when the storm top is in place, and the photo at the right, below this, a view of the interior, with its straw-stuffed gunny-sack buffers, its manger and the cleated gangway, which, when raised, forms the tailgate. Two round holes are bored near the corners of the gangway so that, when it is closed, a rope can be passed through them to hold the thills of the sulkies. The buffers protect the horse from possible bruises while en route over rough roads. Between the sideboards and in front of the manger is a shelf space that is exactly the right size to hold the harness, blankets and other equipment necessary to the business and to the comfort of the horse.

When the storm top is needed, four arches, made of 1¼-in. flat iron, are bolted to the side top rail, the canvas is thrown over them and lashed in place by short cord loops. In pleasant weather the storm top is not used, and the horse is protected with a light fly blanket that covers him from head to tail.

The method of attaching the trailer to the car is shown in the pen-and-ink drawings. A heavy double-action spring is used over the iron coupling rod that tips the end of the tongue. When the coupling pin is driven into place, a large cotter pin prevents it from working out again. The steering has been provided for ingeniously by bending the shackle arm to such an extent that the steering rod may be turned parallel to the front axle and attached to the 5-ft. tongue through a swivel or link which is pivoted on the reinforced axle. Then, as the tongue moves with the car ahead, it automatically turns the front wheels of the trailer as deftly as though it was steered by human hands. The trailer brakes are manipulated from the car driver's seat by means of 3/16-in. wire cable attached to the brake controls and passed through a pulley attached to the end of a single piece of cable. The brake cables are spread by means of pulleys fastened to a cross member on the chassis. The single cable, with the pulley on the end, is passed from the trailer to the car, under the car body, and through the floor of the latter close to the emergency brake lever, where it is handy for the driver.

The front axle of the trailer was reinforced with flat iron, fastened to the axle with clamps. The cost of the job was about $100, besides the work of the owner.

Novel Wood Sled on Wheels

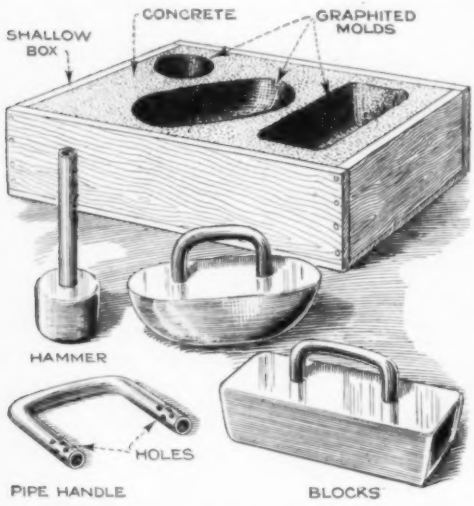
A novel wood sled, which combines the advantages of a sled and a cart, has been built by a western farmer, who uses it for hauling wood over hills and uneven ground, where it is rather difficult to go with the ordinary wagon. It is equipped with heavy iron runners in front and wheels just back of the center of the body. When running on the level or uphill, the wheels alone touch the ground, but when on a downgrade, the load causes the runners to come into play also and no extra pressure falls upon the necks of the team. With this combination cart and sled the farmer has been able to handle twice the quantity of wood that would be possible with an ordinary sled. —Fred S. Walker, Suisun, Calif.

Wood Cart with Runners and Wheels Carries Heavy Loads

873

Concrete Molds for Making Fender Tools

In many repair shops where lead hammers and other tools are used for straightening bent and dented fenders, and other



A Concrete Mold That Enables the Repair Shop to Make Fender Tools Quickly and Easily

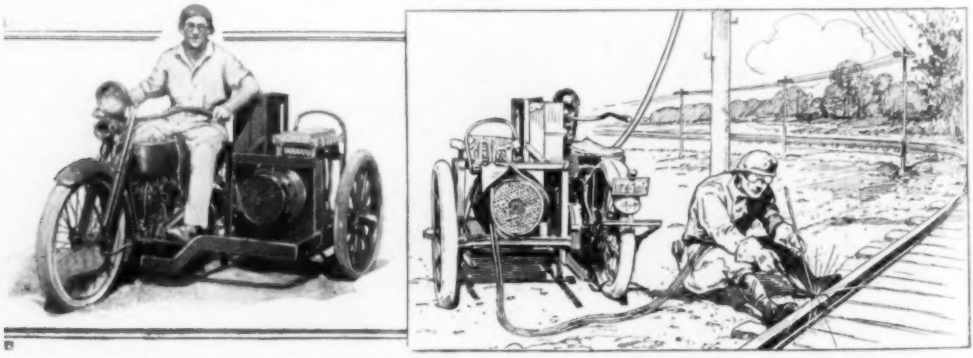
sheet work, the concrete molds shown in the illustration will prove time and labor savers. The method of making these is a simple one. A strong box of suitable size is filled with a mixture of 1 part portland cement to 2 parts sand, using a fairly wet mix. The top is struck off level, and wooden models of the tools to be made are set down into the concrete. The models should have a slight taper or draft so that they can be withdrawn from the concrete easily when it has set, and should be greased before they are put in place. Of course, if similar tools to those that are to be made are available they can be used instead of the wooden models. When the models have been withdrawn after the concrete has set, the insides of the molds are given a coat of graphite, well brushed in, to prevent the lead from adhering to them, suitable handles, made from pipe, are set into the molds, and the lead poured. A few of the tools that can be made in this manner are shown in the illustration.—G. A. Luers, Washington, District of Columbia.

Making Notations on Blueprints Quickly

Blueprints can be marked with notations such as "for approval," "for material only," etc., while they are being run through the printing machine, by using small pieces of tracing cloth with the notations lettered on them, and running these pieces through the machine over blank spaces on the large tracings. This will eliminate the necessity of stamping each sheet separately and also makes a much neater blueprint.—L. H. Georger, Buffalo, N. Y.

Portable Welding Outfit on Motorcycle

A New Orleans power company frequently had to answer emergency calls, such as repairs to broken rails and bonding, and this necessitated a portable welding outfit. To meet this need a welding outfit, with a 150-amp. generator, was mounted on a specially built sidecar frame for a motorcycle, with extension leads that could be hooked up to the power lines. Emergency calls could then be handled quickly and with a minimum loss of time. —T. E. Dabney, New Orleans, La.



Welding Outfit Mounted on Motorcycle Sidecar Frame Enables Power Company to Care for Emergency Calls Promptly

No More Mislaid Tools

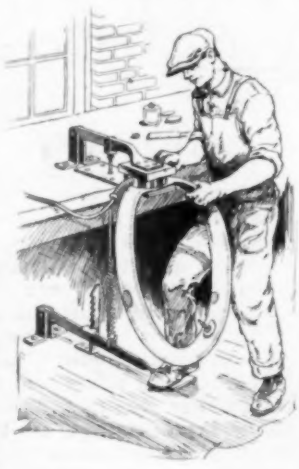
Having charge of an auto-repair shop in which six men were working, the writer found the problem of "keeping up with the tools" a pressing one until the tool board shown in the illustration was made and installed. The board is constructed on one wall of the shop, its size, of course, depending upon the number of tools to be placed on it and the space available. It is made of 4-in. flooring painted some dark color and allowed to dry. Then the tools are held against the board and supported with nails driven part way into the surface. The outline of the tool is traced with a pencil on the board, the tool removed and the outline filled in with white paint.

Tools in Use or Missing Are Indicated at a Glance with the Use of This Board, Which Saves Much Time in the Shop

It requires some time to outline all the tools, but it is well worth the trouble, as one can tell at a glance just what tools are missing when the shop is closed for the night, and the time spent in tool hunting is reduced by half. An ironclad rule requiring all tools to be replaced immediately after use is in force, and the men soon learned to observe it strictly.—F. B. Howell, Mendenhall, Miss.

Foot-Operated Vulcanizer

A Wisconsin tire-service man has eliminated the troublesome necessity of using screw clamps on tubes when vulcanizing them by the device shown in the drawing. It consists of a simple lever arrangement that holds the vulcanizer tightly on the tube, pressure being applied by the foot and the device locked with a ratchet. In this case an electric vulcanizer was used; it is fastened to a lever made of ¼ by 1¼-in. flat iron, pivoted at one end to the bench top. An iron anvil of ½-in. material is screwed to the bench top to project over the edge the end being directly under the vulcanizer. A ¼-in. iron rod, with a coil spring attached, is pivoted to the press arm and the spring hooked to the foot lever, which is also made of ¼ by 1¼-in. flat iron. The operator can adjust the pressure of the vulcanizer by means of the pedal and the device is locked against a ratchet screwed to the floor so that the edge of the foot lever will engage any of the notches. In use, the tube is placed on the anvil, and the vulcanizer locked down on it. When the cure is completed, a slight kick against the pedal releases it so that the tube can be removed.



A Good Drying Oil

To ½ gal. of water add 1 lb. of sugar of lead (poison—lead acetate). Shake occasionally, and when the lead is dissolved add 2 qt. of water; then filter the solution and add 3 gal. of raw linseed oil. Stir in 1 lb. of powdered litharge, shake it often and then let it stand for several days. The oil found on top will be the drying oil, and it must be poured off into another vessel. The liquid is clear and bright and dries in about 24 hours.

Safety Basin for Washing Small Machine Parts in Gasoline

In almost every garage or repair shop a pan of gasoline is kept on the workbench for the washing of small machine parts. Such a practice is not only wasteful but also dangerous, especially where the work room is accessible to the public. A much better arrangement, and one that will meet with the approval of the insurance inspector, is shown herewith.

Novel Wash Pan for Cleaning Small Machine Parts in Gasoline

A 3-ft. length of 1¼-in. gaspipe is inserted through the center opening of a 5-gal. gasoline can and soldered securely in place, so that the lower end of the pipe is about 1 in. above the bottom of the can. Four braces are also soldered or welded onto the pipe and to the top of the gasoline can to strengthen the device. A floor flange is screwed to the upper end of the pipe and a basin soldered to this, a hole being punched through the bottom of the basin to receive a stopper. A valve from an inner tube is soldered in the top of the can as shown, and an air-tight cap, provided with a metal wing, is screwed on the spout.

In use, a tire pump is attached to the valve and after two or three gallons of gasoline have been poured into the can through the basin funnel, opening the cap on the spout to let out air and then closing it again, air is pumped into the can, forcing the liquid to rise into the basin. The cork stopper is then inserted in the opening in the basin to retain the gasoline while the machine parts are washed. By removing the cork and loosening the cap on the spout, the air is allowed to escape from the can and this permits the gasoline to flow back into the can. If a solution of washing powder dissolved in hot water is poured into the basin occasionally, the grease and foreign matter in the gasoline will be made to settle to the bottom of the can, and a clear liquid will result. Once a week, or so, the clear liquid should be drawn off and the can cleaned out thoroughly.

Overcoming Dredging Difficulties

By A. W. BURG

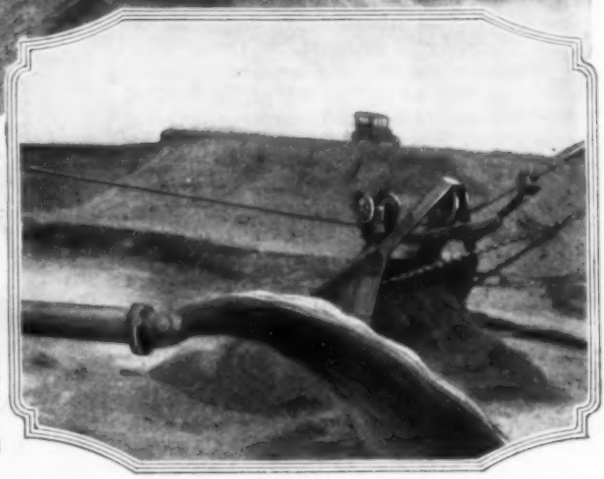
AS superintendent of a large gravel company, I was confronted with the problem of getting the 10-in. suction-dredge line under the track cable of the slack-line excavator without hindering the operation of either dredge or excavator. The pumping dredge moved the sand and gravel from the bank to a point under the track cable of the excavator, which dug the material again and conveyed it to the hopper of the screening plant.

Ordinarily a 30-ft. suction pipe was used, handled by a mast and boom on the end of a boat. Power for raising the suction pipe was furnished by a hoist belted to the main engine. In order to dig under the track line while it was in operation, a framework was built on two pontoons and arranged so that the pipe could be raised and lowered between the two. As the dredging continued forward, more pipe was added to the suction and discharge pipes and more pontoons placed under the pipe to support it. Flexible-hose connections were used where the suction pipe was connected to the pump and at the first joint back of the submerged part of the suction pipe. Enough pipe was added in this way until a bay had been formed on the further side of the track line, the bay being large enough so that the dredge could be moved there without interfering with the operation of the cable. The floating extension to the suction pipe was then discarded, and operations continued with the short suction pipe.

Arrangement of Pontoons to Carry Suction Pipe; Track Cable Shown in Upper Part of Photo

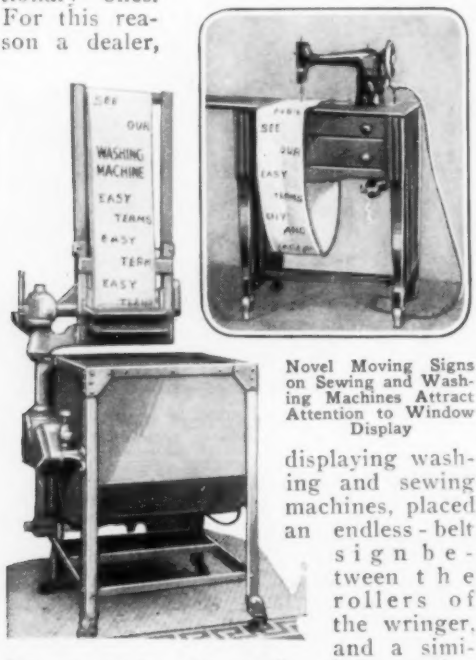
Screening Plant and Receiving Hopper, with Mast

General View of the Plant; the Track Cable for the Excavator Is Shown at the Right Crossing the Suction Pipe Carried on the Pontoons, and at the Left the Discharge Pipe Is Also Carried on Pontoons to a Point beside the Track Cable; Below, the Discharge Pipe, Throwing Material in Front of the Excavator Bucket



Moving Signs for Small Stores

Moving signs in windows are much more apt to attract attention than stationary ones. For this reason a dealer,



Novel Moving Signs on Sewing and Washing Machines Attract Attention to Window Display

displaying washing and sewing machines, placed an endless-belt sign between the rollers of the wringer, and a similar one under the needle of the sewing machine. The machines were put in operation and this caused the signs to move around continuously.—Charles Abbot Goddard, Los Angeles, Calif.

Precautions in Painting

Do not use any paints containing compounds of lead about stables or outbuildings where the fumes from decaying organic matter are present, as these gases are likely to darken the lead paints. Do not use with lead paints any pigments that may liberate compounds of sulphur; for example, ultramarine blue, which contains sulphur in a form in which it may be set free, is a beautiful and very permanent blue, and may be used with zinc white, but it should not be used with white lead or any other lead pigments. Prussian blue, on the other hand, does not contain sulphur, and may be used with lead pigments.

Remember that turpentine and benzine are very inflammable; hence special precautions should be taken not to bring paints containing these substances near an open fire. Many pigments are poisonous, and the workman should be careful to remove all paint stains from the skin, and not under any circumstances allow any paint to get into his mouth. One should not eat in the clothes in which he has been painting, and should always be particular to wash the hands thoroughly before eating. It is not advisable to use turpentine or benzine to remove paint stains from the hands, but rather to oil thoroughly with linseed oil or, in fact, any fatty oil; then, by washing the hands well with soap and water the paint may be removed, provided it has not been allowed to dry too hard on the skin.

Treatment for Mildewed Burlap

When burlap wainscoting becomes damp it mildews. The dust of this may be brushed off with a stiff bristle brush, after which a size made in the following way is applied: Dissolve 4 oz. of pulverized alum in 1 gal. of hot water, 4 oz. bluestone (poison) in 1 pt. of hot water, 2 oz. white glue in 2 qt. of water, and 2 oz. sugar of lead (poison) in 1 qt of water. Make these solutions separately and then mix them together, the bluestone solution last. Apply with a broad brush and let it dry.—A. A. Kelly, Malvern, Pa.

Wheeled Hog Swiller

On the farm where hogs are kept a swiller of the kind shown in the photo will be found very handy, as it can be readily pushed around and its contents quickly dumped into the feeding troughs. It consists of an old steel oil drum with the top cut off, mounted on wheels. The wheels were taken from an old cultivator, the handles were cut from

Wheeled Hog Swiller Lightens Farm Chores

the tongue and the frame was also taken from the same implement.

Prize Offers and Announcements

$150—Best New Uses for Stop Watch

In two awards of $100 and $50; also ten additional awards of one stop watch each. These offers are made for the best lists of uses for the Pastor stop watch, which is an accurate instrument consisting of a time-piece and a stop watch in one. The larger one of the cash offers will be paid for the best list, the smaller sum for the second best and a Pastor stop watch, valued at $7.50, will be given for each of the next ten best series of uses received. Each use should be stated briefly and simply and numbered according to its place on the list. Write on one side of the paper only, with name and address on each sheet. Address all replies to Industrial Award, Sterling Watch Company, 15 East Twenty-Sixth Street, New York, N. Y. Offer closes May 1, 1925.

$1,000—Article to Increase Brass Uses

With the person who designs some acceptable article which is composed of considerable brass in the form of sheet, rod or tubing, and which can be protected by patent, or with anyone who develops an acceptable plan wherein brass can be successfully and usefully substituted for a competing material now used in established articles of commerce, the Bridgeport Brass Company will enter into an agreement to pay royalties on the basis of such an invention, plan or suggestion, up to $1,000. The Bridgeport Brass Company will be the sole and final judge in reaching a decision regarding the commercial value of the invention, plan or suggestion, but if the company approves and enters into such an agreement in any instance, and reward is paid up to an aggregate of $1,000, payments shall then cease and the Bridgeport Brass Company shall become proprietor of all rights, privileges and returns from the promotion, manufacture or sale of any such patent, plan or suggestion the Bridgeport Brass Company adopts under this offer. May 1, 1925, is closing date for this offer. Address Bridgeport Brass Company, Bridgeport, Conn.

$1,000—Adjustable Miter Box

The sum of $1,000 in cash and a satisfactory royalty will be paid by Roche and Moore for a suitable miter box for carpenters, to be employed with the ordinary handsaw. The design must be such that it can be easily and quickly adjusted to any arc of a half circle. It should be one inexpensive to manufacture, should be light in weight and preferably planned to be constructed of either wood or steel. No models of suggested designs should be submitted until after the drawings or sketches have been sent to the donor. This concern reserves the right to be the sole judge of the merits of all ideas submitted and their availability for adoption by our organization. Address Roche and Moore, Cochranton, Pa. This offer expires May 1, 1925.

$100—Galvanized Steel Garage Design

The sum of $100 in cash and royalties over a period of years will be paid to the person submitting to this donor a satisfactory design for a galvanized-steel garage. It must be of simple construction and yet be sufficiently strong to withstand windstorms and snow loads on the roof. The design must be original and patentable. All matter submitted will be passed upon solely by the donor. Address, John B. Berger, P. O. Box 792, Baltimore, Md. Offer closes May 1, 1925.

$200—Electric Sign Controls

The Acme Electrical company will pay the sum of $200 in cash for the drawings of controls for an electric flashing sign. The sign is to consist of not less than 300 lamps. The controls are to operate so that separate advertisements can be shown in rotation. No metal or wood letters are to be used. The advertising matter is to be composed from the bank of 300 lamps. This concern will reserve the right to reject any or all plans offered, and guarantees the return of all those not accepted, postage prepaid. This offer expires May 1, 1925. Address, Acme Electrical (Blackpool) Co., Richmond Chambers, 106B, Church Street, Blackpool, England.

$250—Pulley-Using Machine

The Standard Pulley and Manufacturing Company is in search of some sort of machine on which cast-iron pulleys would be the principal item and which would have a demand that cou'd justify its manufacture by this concern in fairly large quantities. We will pay the sum of $250 in cash to anyone who submits a suggestion for such machine, provided the suggestion is accepted and used by this company. This organization will act as sole judge of any and all ideas submitted to it. Address, the Standard Pulley and Manufacturing Company, Cincinnati, Ohio. This offer expires May 1, 1925.

PREVIOUSLY ANNOUNCED

ALL OFFERS CLOSE MAY 1, 1925

FOR SKYROCKET STICK HARMLESS IN descent, $1,000; bombshell with illuminated flag, $250; chemical combinations to produce smokeless fireworks colors, $250. Thearle-Duffield Fireworks Company.

MOTOR-OPERATED HANDSAW FOR MANUfacture and sales; award, $10,000 in royalties. R. L. Barker and Company.

ELECTRIC HEATING ELEMENT WHICH will operate and interchange with base and cover of Imperial self-heating gasoline iron, $500. Imperial Brass Company.

TO ANYONE WHO WILL PRODUCE FOR them a saxophone reed to satisfactorily replace the present reed, the Buescher Band Instrument Company will pay the sum of $1,000.

THE PHENIX RADIO CORPORATION WILL pay the sum of $1,000 for the design of a new form of condenser for radio reception.

FOR A SATISFACTORY HAMMER-BLOW arrangement for portable hammer drill, the Wodack Electric Tool Corporation will pay $500.

THE SUM OF $25 WILL BE PAID BY CELLO Products, Inc., for suggested new uses for its product. Information from the concern on request.

$2,000 WILL BE PAID BY THE NORTH Shore Food Products Company for a method of processing or preserving cottage cheese to keep it fresh for at least two weeks.

FOR THE BEST SUGGESTED IMPROVEment on a gasoline-heated blowtorch and soldering and branding iron combined an award of $500 will be paid by the Everhot Manufacturing Company.

TO THE PERSON SUBMITTING TO THEM an article which they can make in their machine and electrical shop, the Guyan Machine Shops will pay $250 over and above its royalties or sales price.

GRANITE STATE MOWING MACHINE COMpany offers $500 in cash and royalties for satisfactory working drawings for gasoline-motor lawn mower they accept for manufacture and marketing.

AWARDS OF $500 EACH WILL BE PAID for a waterproofing process for a library paste and a method that will produce increased sales of this product. John J. Harris and Company.

THE SUM OF $50 IS OFFERED BY THE Parsons Manufacturing Company for the best plan they receive for uses of ground slate.

Full Details Regarding the Previous Offers Listed Above, May Be Obtained by Addressing the Bureau of Information, Popular Mechanics Magazine

Radio Set for Tourists 25 CENTS

Radio Questions and Answers

Q. I have a five-tube neutrodyne receiver, and I am told that I should have my tubes matched. Is this necessary? A. Many sets that have three or more tubes will work better if the tubes are changed from one socket to another. All tubes of the same type are supposed to have the same amplification factor; this, however, is not always true. Tube matching is very simple if you are equipped with or have access to the proper instruments, and many dealers will do this for you when you buy the tubes. It is of value to have matched tubes in the radio-frequency stages.

Q. What size wire is best to use in wiring a radio receiver? Should I use insulated wire or bare wire? A. Use No. 14 tinned-copper wire. Use "spaghetti" tubing if you wish, but insulation is only necessary where the wires run close together. Always keep the grid and plate leads as far apart as possible.

Q. What size rheostat should I use with a UV-199 tube? I am making a one-tube Ultra-Audion receiver like the one you described in the April, 1924, issue. A. The 40-ohm rheostat was recommended in the article. You will find it listed in the material list. You can use a 35-ohm rheostat if you wish.

Q. I live in the country and do not wish to erect an aerial mast. There is a large tree in the yard that I could use to support the far end of the aerial. Is this a good plan or must I put up a mast? A. A tree will answer the purpose, but certain precautions must be taken. For example, if the aerial wire is tight the swaying of the tree will likely snap it. Connect a heavy spring to the aerial, with an insulator at each end to compensate for this swing. Also see that the aerial wire does not come in contact with leaves or branches. It may be necessary to place an insulator out far enough from the tree to insure clearance.

The Radio Department is willing and anxious to serve you. If you contemplate buying or building a set, we will be glad to advise you in selecting the proper instrument to suit your purpose, furnish you a circuit, or tell you where to get the best parts. When you run into trouble in building or operating your set, tell us about it, and we will endeavor to clear it up for you.

Address all inquiries to the Radio Editor, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

Q. I am a beginner in radio, but have built all of my own equipment as far as possible. I have a good make of storage battery, and the directions caution me to watch the water level in the various cells. I notice one cell drops much quicker than the others. What is the reason for this, and what must I do? A. Evidently the hard rubber jar containing the plates in this cell is cracked, and permits the solution to escape. There is nothing that you can do except replace the cracked container. We would advise that you place the battery in the hands of your local battery-repairman at once.

Q. I have a quantity of aluminum wire, can I use this for an aerial? A. Aluminum wire is not recommended for aerials. Use No. 14 copper wire or a good grade of stranded antenna wire, plain or enameled.

Q. Will one step of audio-frequency amplification give me sufficient volume to operate a loud speaker? A. One step will not give much volume with the average receiver on a loud speaker. It is the second step that has the greatest amplification. However, on local stations one step may prove satisfactory.

Q. I have two old B-batteries. These indicate about 12 volts each. Can I add these old batteries to my new ones as the voltage in the latter drops to make up for the loss? If so, how should I connect them? A. This is not advisable, as the B-battery should be discarded when it drops below 18 volts. Below this voltage the battery becomes noisy, and adds resistance to the plate circuit.

Q. Is it better to buy small B-batteries and renew them often, or to buy the larger type? A. The larger sizes are in the end much cheaper than the smaller sizes, as they will last longer in proportion.

Q. Will the addition of a C-battery give me more volume, if connected in the filament negative lead to my audio-frequency transformers? A. Yes, this will give you more volume, and will prolong the life of your B-batteries.

Q. I have a one-tube non-regenerative receiver, and would like to get more volume. Would you advise me to change to a regenerative set? A. No; it would be better to add a step of audio-frequency amplification than to use regeneration. High regeneration will cause your set to howl and interfere with other sets in your neighborhood.

Q. Does the use of radio-frequency amplification when added to my receiver cause more noise in the set? If so, why? A. Radio frequency amplification greatly increases the strength of weak signals, and in the same proportion builds up the volume of strays, and interference otherwise unheard. This is especially true when an outside antenna is used, as it gathers many strays that could be eliminated by the use of a loop. Radio-frequency amplification makes the use of a loop possible. The use of a loop will no doubt eliminate a large portion of your trouble.

Q. I have a 3-tube receiver and am using WD-12 tubes. Can I get more volume and distance by using a UV-200 for the detector and two UV-201A tubes for the amplifiers? A. Yes, you will obtain more volume and range with the standard tubes. It will be necessary for you to use a vernier rheostat on the detector tube as the filament control will be more critical. Use a 6-ohm rheostat for the detector tube and two 25-ohm rheostats for the UV-201A tubes. You can also use a higher plate voltage on the standard tubes. We would advise from 67 to 90 volts for the B-battery.

Q. I am having trouble with my B-batteries; they run down very quickly. I recently bought some new tubes not of standard make. Since using these tubes I have had to renew my B-battery twice. Could it be possible that these tubes use more current? A. This is probably the case. Defective tubes draw more plate current than their rating. Some "bootleg" tubes draw from two to three times more current than standard tubes. Better stick to standard tubes.

Q. I am having trouble with my three-coil honeycomb regenerative set. The circuit is correct but the signals have no volume. What can I do to get more volume? A. Your trouble may be that the connections to the tickler coil are reversed. It is also possible that the tickler coil may not be large enough; to find out, try a 35-turn coil.

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